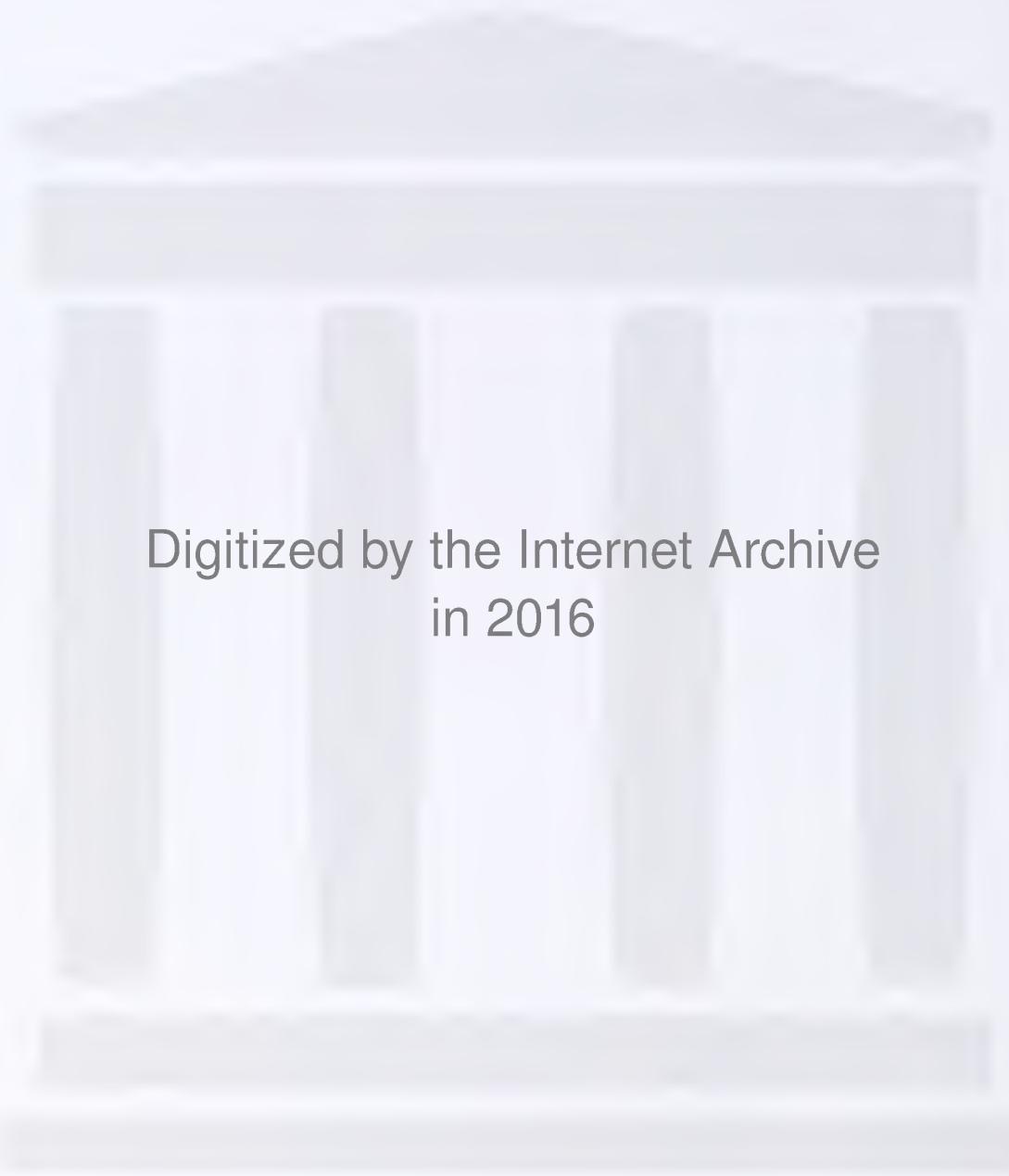


Operation Desert Shield / Desert Storm

USA
EHA

History of Participation by the
U.S. Army Environmental Hygiene Agency
Aberdeen Proving Ground, Maryland





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DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-6422



REPLY TO
ATTENTION OF

HSHB-CE (870)

15 October 1992

MEMORANDUM FOR Commander, Army Medical Department Center and School, ATTN: HSMC-GHI, Fort Sam Houston, TX 78234-6100

SUBJECT: History of Participation

Enclosed is the History of Participation by this Agency in Operation Desert Shield/Desert Storm.

FOR THE COMMANDER:

Encl

Evelyn B. Riley
EVELYN B. RILEY
Public Affairs Officer

OPERATION DESERT SHIELD/ DESERT STORM

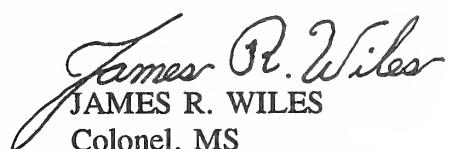
History of Participation by the
U.S. Army Environmental Hygiene Agency
Aberdeen Proving Ground, Maryland 21010-5422

7 August 1990 - 31 December 1991

Prepared By:


EVELYN B. RILEY
Historian

Approved By:


JAMES R. WILES
Colonel, MS
Commanding

THE FORMER COMMANDER OF THE U.S. ARMY ENVIRONMENTAL HYGIENE AGENCY

A MESSAGE FROM THE FORMER COMMANDER

It readily became obvious that our Agency was going to play a pivotal role in the preventive medicine support to Operation Desert Shield/Desert Storm from the very beginning. When the Preventive Medicine Consultants at Headquarters, U.S. Army Health Services Command and in the Office of The Surgeon General at Department of the Army started mapping a support strategy, our Agency was mentioned in every sentence.

We often hear that "generalists" are needed to support the Army and that perhaps we don't need highly technical scientists in uniform or as Department of Army civilians -- we can contract for these skills. As we know, this is faulty logic; expertise in military-unique situations and the quick-response capability does not exist through contracting. During every past war, conflict, disaster or emergency, the sophisticated skills were required quickly, within TOE organizations, and on the battlefield. It is so much easier to maintain a generalist capability within a group of highly trained and skilled individuals than it is to try to ramp-up generalists to provide sophisticated consultation and support. This was again proven during Operation Desert Shield/Desert Storm. Specific and detailed entomological, water, wastewater and epidemiological expertise was required from the very initial stages during the training to deploying units. This training was highly effective because soldiers listen to soldiers -- they want to feel the brethren-in-arms comradery.

As the war progressed, questions began to flood USAEHA. We were talking two and three times daily to our battlefield counterparts. Our civilian expertise began to shine. We were able to quickly provide detailed answers to questions such as the impact of oil on the reverse osmosis water purification units, the problems associated with exposure to acetates and isocynates when camouflaging vehicles outdoors with CARC, the medical effects of directed energy exposure, the hazards associated with the lasing of our personnel, the impact of rounds containing depleted uranium,



high calcium salts in the water, disease threats, and the need for quick turnaround on chemical analysis of samples.

Even during the fighting, we were in daily contact with the on-ground preventive medicine personnel and available to provide constant consultation. Additionally, we shipped over \$100,000 worth of analytical and industrial hygiene equipment.

The bottom line is that our soldiers and civilians responded to the needs of our Army. We provided customer satisfaction for the personnel that were in Harm's Way.

A handwritten signature in black ink, appearing to read "Ronald M. Bishop".

RONALD M. BISHOP
Colonel, U.S. Army

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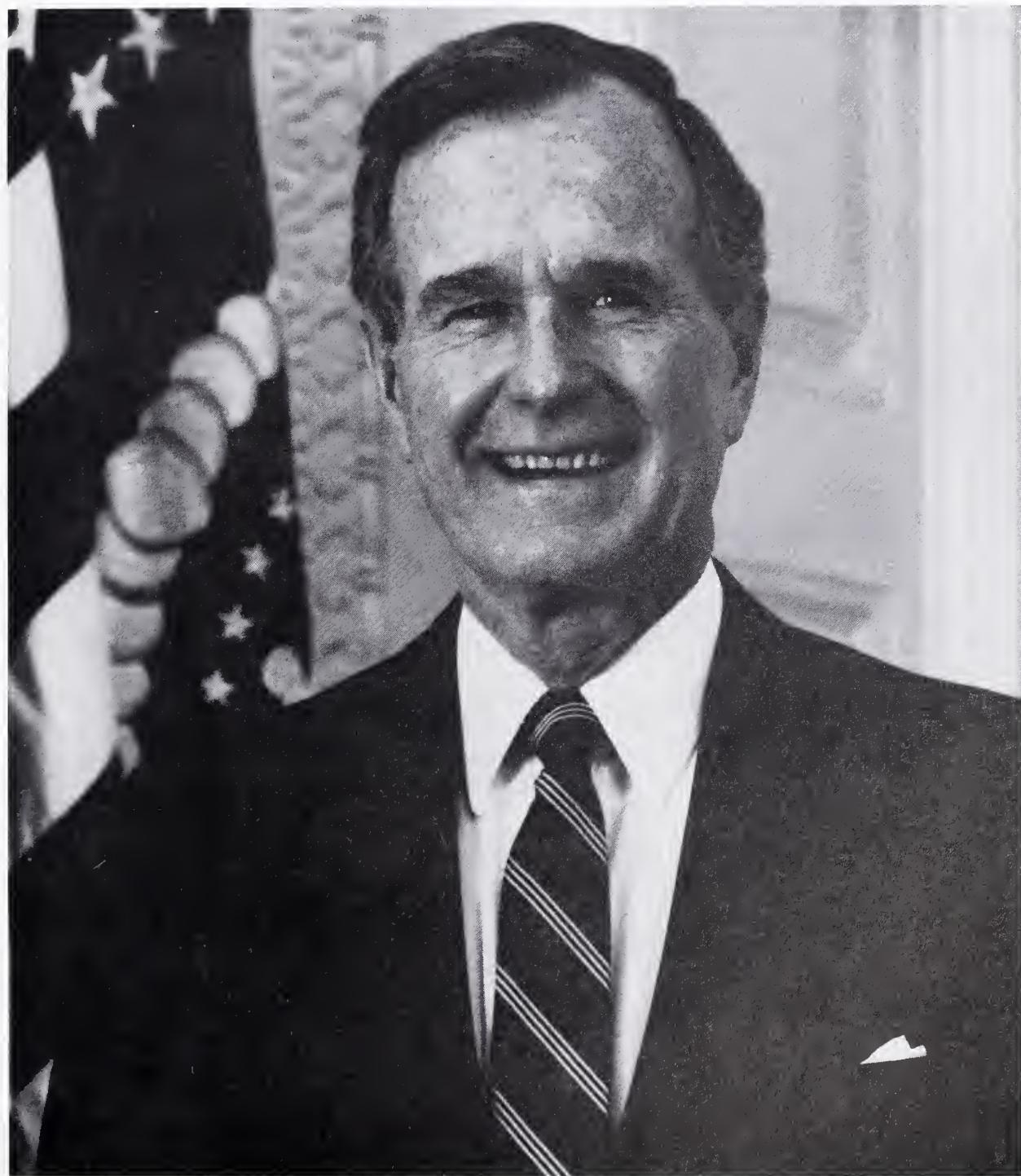
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"We went halfway around the world to do what is normal and just and right. We fought hard, and - with others - we won the war. We lifted the yoke of aggression and tyranny from a small country that many Americans had never heard of, and we ask nothing in return."

PRESIDENT GEORGE BUSH
March 6, 1991

CHRONOLOGY

<u>DATE</u>	<u>EVENT</u>
<u>August 1990</u>	
2	Iraq invades Kuwait.
5	President Bush declares the invasion will not stand after a 4 Aug meeting with advisers.
7-8	President Bush orders a major deployment of U.S. military forces to Saudi Arabia to defend it against Iraqi attack, the first of many partings that will escalate quickly to include a half-million troops.
<u>November</u>	
8	President Bush orders more than 150,000 additional American ground, sea, and air forces to the Persian Gulf to join the more than 230,000 American troops in the region.
22	President Bush spends Thanksgiving Day with troops in Saudi Arabia.
29	The U.N. Security Council votes 12-2 to give Iraq 6 weeks - until 15 Jan - to pull out of Kuwait. After the deadline, Kuwait's allies may use all necessary means to force Iraq to withdraw.
<u>January 1991</u>	
9	After 6 hours of talk in Geneva, U.S. Secretary of State James A. Baker III and Iraqi Foreign Minister of Tariq Aziz fail to reach a peace agreement.
12	Congress votes President Bush the authority to go to war against Iraq.
15	U.N. deadline passes without Iraqi withdrawal.
17-18	U.S. and allied forces begin air attacks on targets in Iraq and occupied Kuwait in the first sorties. By the end of the war, more than 100,000 sorties will have been flown. Iraq fires first Scud missiles at Israel.
19	Israel's anti-missile force is boosted by additional Patriot missile batteries and U.S. crews. A second Iraqi missile attack causes 29 injuries in Tel Aviv, Israel.

January (cont.)

22 Iraq sets some Kuwaiti oil facilities ablaze. Oil prices jump sharply.

23 After more than 12,000 sorties, the allies claim air superiority and focus strikes on the Iraqi ground forces around Kuwait.

25 Allied officials say Iraq sabotaged Kuwait's Sea Island Terminal, dumping millions of gallons of crude oil into the gulf.

February

13 Allied warplanes destroy an underground facility in Baghdad, where Iraqi officials say civilians were sheltered. The U.S. calls the target a military command center. The U.N. Security Council votes 9-2 to hold a closed formal session on the conflict, the first since the war broke out.

15 Iraq offers to pull out of Kuwait but links a withdrawal to other issues, including Israeli withdrawal from its occupied territories. President Bush dismisses proposal as a "cruel hoax." Bombing continues.

15 Six hundred and five oil wells were ignited.

19 At the United Nations, the Soviet U.N. ambassador told the Security Council that Moscow's Persian Gulf peace plan seeks rapid pullout of Iraqi forces from Kuwait, with full compliance to U.N. resolutions. President Bush rejects the peace proposal, saying there must be no negotiations and no concessions.

22 President Bush, speaking for the coalition, rejects the Soviet-Iraqi plan. He tells Saddam Hussein to begin withdrawing Iraqi forces from Kuwait by noon EST (8 p.m. gulf time) 23 Feb. The withdrawal must be completed within 1 week and all prisoners of war must be released within 48 hours.

23 The noon deadline passes without signs of Iraqi withdrawal. The U.S. and its allies launch a large-scale ground assault.

24 The Screaming Eagles of the 101st Airborne Division blast deep into Iraq to cut supply lines and establish a forward base. By day's end U.S. paratroopers are reported holding outer edges of Kuwait City.

February (cont.)

25 Saddam Hussein orders his forces to withdraw from Kuwait, Baghdad radio reports. White House press secretary Marlin Fitzwater says, "The war goes on."
The Iraqis send a Scud missile flying into Saudi Arabia. Breaking up in the sky, it falls on a U.S. barracks near Dhaharan, killing 28 servicemen and women.

28 After 100 hours, the ground war is halted. Iraq agrees to a temporary cease-fire.

March

3 Iraq accepts conditions for permanent cease-fire.

April

27 President Bush declares "Kuwait is liberated" and orders the midnight suspension of offensive military operations. The effort to retake Kuwait City is in its final stages.

28 Allied officials say a truce declared 100 hours after the ground war started was holding in the 43-day war.

16 The Surgeon General tasks USAEHA to conduct an environmental characterization of Kuwait Oil Fires.

May

5 May -
31 Dec USAEHA conducts the Kuwait Oil Fire Health Risk Assessment Study.

November

6 The last well is capped.

June 1992

19 Interim Report, Kuwait Oil Fire Health Risk Assessment No. 39-26-L192-91 is submitted to the Surgeon General.

CHAPTER 1

ORGANIZATION, MISSION AND COMMAND

Section I. INTRODUCTION

1-1. AUTHORITY. Memorandum HSTR (870), U.S. Army Health Services Command, 25 April 1991, subject: Operation Desert Shield/Storm (ODS) Historical Documentation. (Appendix G)

1-2. MISSION. We support the world-wide preventive medicine programs for the Army through consultations, supportive services, investigations, and training in the areas of environmental quality, occupational and environmental health, toxicology, disease prevention, surveillance and control, radiation and environmental sciences, pest management, and laboratory services. We review proposed environmental, safety, and health standards or standards criteria documents published for comment by regulatory agencies and consensus standard organizations. We conduct the Army Preventive

Medicine Residency Training Program in occupational medicine to meet accreditation requirements of the American Council on Graduate Medical Education and approval requirements of the American Osteopathic Association.

1-3. ORGANIZATION.

a. An organizational chart is shown on page 1-2; the location and geographical areas of responsibility of the USAEHA activities are shown on page 1-3.

b. Personnel data are in Appendix A.

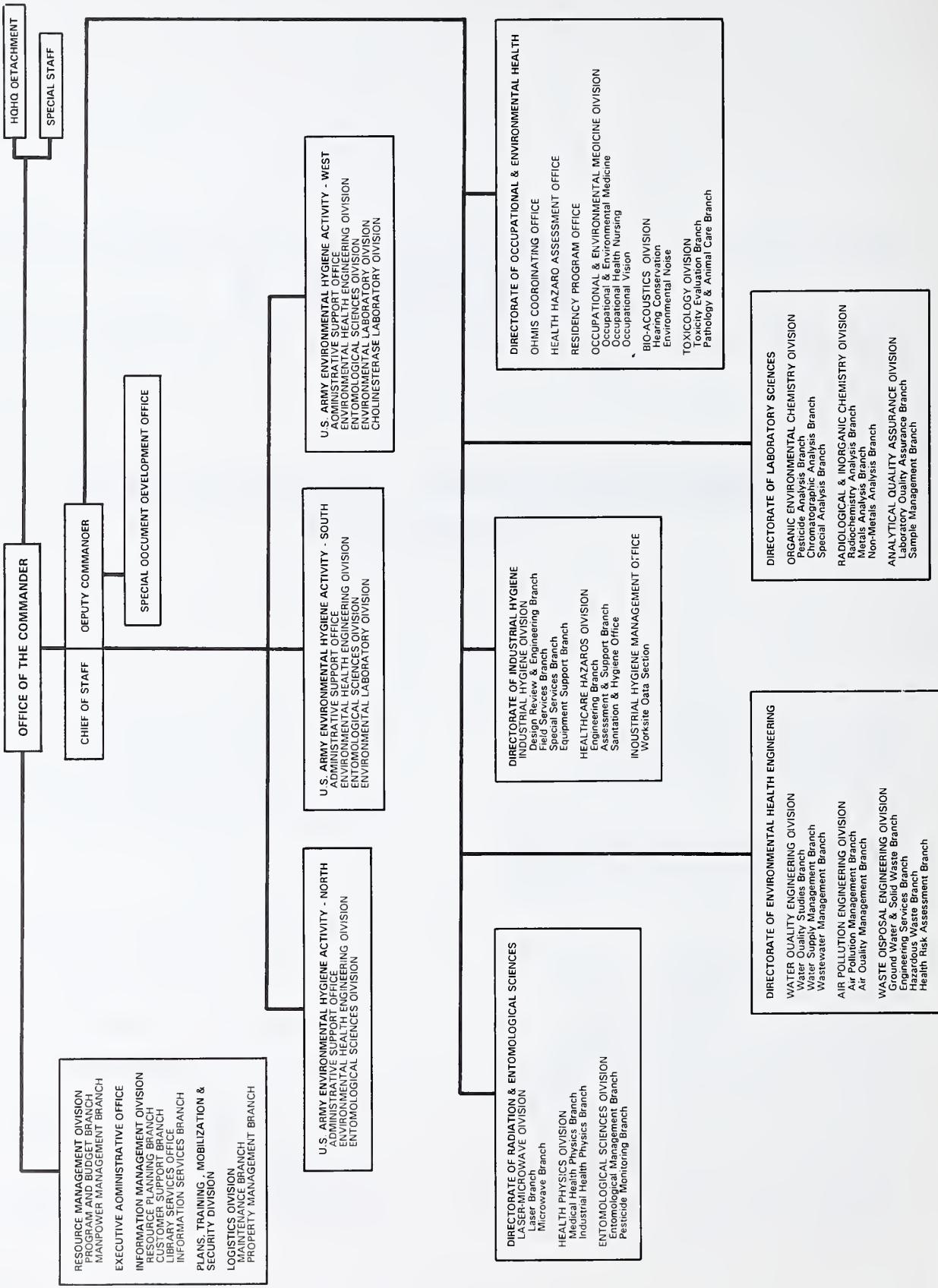
1-4. SPECIFIC DOCUMENTATION.

a. This is the separate history alluded to in paragraph 1-11b, Annual Historical Report - AMEDD Activities, USAEHA, 1991.

b. This history documents our participation in ODS/Kuwait. Much of the work was done prior to



U.S. ARMY ENVIRONMENTAL
HYGIENE AGENCY



DIRECT SUPPORT		
GENERAL SUPPORT		
Program Number	Program Title	Program Manager
OEMD 11	Occupational Medicine Residency	LTC Stone
ESD 16	Pest Management	Mr. Wells
ESD 17	Pesticide Risk Management	Dr. Evans
LMD 24	Radio Frequency Radiation/Ultrasound	Mr. Hicks
LMD 25	Laser/Optical Radiation	Dr. Slaney
HPD 27	Industrial Health Physics	Mr. Edge
HPD 28	Medical Health Physics	CPT Bower
WQED 31	Water Supply Management	MAJ Jones
WQED 32	Wastewater Management	Mr. Fifty
WDED 37	Hazardous and Medical Waste	Mr. Resta
WDED 38	Ground Water and Solid Waste	Mr. Bauer
WDED 39	Health Risk Assessment	Dr. Heller
APED 42	Air Pollution Source Management	Mr. Daughdrill
APED 43	Ambient Air Quality Management	Mr. Guinivan
BAD 51	Hearing Conservation	Dr. Othlin
BAD 52	Environmental Noise	Dr. Luz
OHMIS 53	Occupational Health Management Information System	Dr. Dash
IHD 54	Special Industrial Hygiene Projects	Ms. Doganiero
IHD 55	Industrial Hygiene	Mr. Graham
IHD 55	Healthcare Hazards	MAJ Testa
HHD 56	Sanitation and Hygiene	CPT McDevitt
IHD 57	Industrial Hygiene Management	Ms. Arnold
IHD 59	Occupational Vision	MAJ Thompson
OEMD 63	Occupational & Environmental Medicine	Dr. Lachiver
OEMD 64	Occupational Health Nursing	LTC Probst
OEMD 65	Special Document Development	Ms. Weyandt
SDDO 66	Health Hazard Assessment	MAJ Tompkins
HHA 69	Analytical Quality Assurance	Mr. Fisher
AQAD 74	Toxicology Assessment	Mr. Weeks
TOX 75	Organic Environmental Chemistry	Mr. Belkin
OECD 76	Radiochemical and Inorganic Chemistry	Dr. Boldt
RICD 78		

USAEHA Direct Support Activities' Locations and Geographical Areas of Responsibility



and after the ODS established dates of 7 August 1990 - 28 February 1991. It covers a wide array of disciplines and shows our matrixed organization in the occupational and environmental health areas.

Section II. GENERAL

1-5. GLOSSARY. A glossary of abbreviations used is in Appendix B.

1-6. FIELD TRAINING EXERCISE. The majority of our service members that were deployed from USAEHA to Saudi Arabia had recently participated in a three-day field exercise that emphasized chemical protection. See Appendix C.

1-7. YELLOW RIBBONS. We purchased yellow ribbons, made yellow bows, and proudly hung them outside of each of our buildings at APG. The origin of yellow ribbons is shown in Appendix D.

1-8. SUPPORT FOR THE TROOPS. One of the main concerns for our troops in Saudi was safe drinking water. It is part of our mission to support the troops in this endeavor. Since we couldn't provide water itself - we did the next best thing and provided containers. See Appendix E.



SFC(P) Kenneth Varner places a yellow ribbon in front of Building E2100 in honor of our troops.



USAEHA employees prepare Pepsi bottles for our troops in Saudi Arabia.

CHAPTER 2

PRELUDE AND THE WAR

Section I. PRE-CRISIS

The entire Agency supported ODS. Multiple teams, consisting of both military and civilian experts, were involved as outlined below.

2-1. AIR POLLUTION.

a. In February 1986, Mr. Brian D. Jones, Air Pollution Engineering Division, performed testing of U.S. Army field kitchen stoves which were being converted from burning mogas to diesel fuel. This conversion followed an Army wide move to replace mogas powered vehicles with diesel powered units. Natick Research and Development Center requested our assistance to determine if noxious gas would accumulate in dining facility tents while firing the stoves with diesel fuel. Emission estimates were provided for the stoves and a set of simple and economical test methods were developed. **IMPACT:** The field kitchens were used in ODS.

b. Mr. Brian D. Jones and Mr. Robert G. Wishart, Air Pollution Engineering Division, assisted in the permitting of hazardous waste incinerators under Resource Conservation and Recovery Act (RCRA) laws from 1988 - February 1991. The RCRA trial burns for waste propellant incinerators at Radford Army Ammunition Plant, Virginia, and on a deactivated furnace at Tooele Army Depot, Utah, were conducted. Trial burn test plans were written for other plants during the period 1988 - February 1991. **Impact:** This assistance enabled these facilities to continue operation and to produce ammunition to support ODS.

c. 2LT Alan K. Lee, Air Pollution Engineering Division, supported the Engineering and Housing Support Center 16-27 April 1990. The Corps of Engineer Prime Power Programs maintains an inventory of mobile generators to support theater commanders during military contingency operations when tactical generators can no longer satisfy electrical power requirements.

An air pollution engineering study of the prime power assets was conducted to characterize the air pollution emissions from a number of the mobile diesel generators and gas turbines. These data were used to gain approval for use of these assets by environmental regulators in the various states and foreign locations where they may be deployed. **Impact:** Equipment from the Prime Power Program was used in ODS.

2-2. CHEMICAL WARFARE. Mr. Hubert L. Snodgrass, Jr., Toxicology Division, supported a request from the Medical Research Institute of Chemical Defense, August-October 1990 and 13-18 January 1991. The Toxicology Division evaluated Multi Shield, a skin lotion which protects against the effects of chemical agents. The Food and Drug Administration (FDA) would not permit DOD-use until basic skin and photochemical irritation tests were performed. These were completed by USAEHA; the results were audited by the FDA and accepted. Prior to shipment to the Middle East, a sample from the Multi Shield product run was also tested, but unlike the first, caused significant skin irritation. **Impact:** Further production and shipment was halted immediately, pending a review of the manufacturing process.

2-3. CLOTHING AND INDUSTRIAL EQUIPMENT. Mr. Douglas C. Nelson, Toxicology Division; Mr. Robert A. Gross, Health Hazards Assessment Office; and Majors Gary L. Shrum and Richard W. Lachiver, Occupational and Environmental Medicine Division, evaluated the Lightweight Chemical and Biological Protective Garment (LCBPG), February 1990 - February 1991. The request came from the Program Manager for Clothing and Individual Equipment. The LCBPG program was aimed at fielding an NBC protective overgarment which would reduce heat stress and provide degraded agent protection for high-priority, risk-taking missions. The LCBPG is a nondevelopmental item acquisition program. The first candidate which received considerable testing was the British Mark IV. Our analysis of the Mark IV showed that it provided not only modest heat stress reduction but markedly reduced chemical protection. Although a final decision has not been made, it does not appear that the Army will purchase the Mark IV. The German Von Blucher is now being investigated as a

candidate to fulfill the LCBPG requirement.

Impact: This study allowed the Army to make an informed decision on the effectiveness of the British Mark IV. Additionally, during the process of evaluating this garment, several deficiencies in the current mechanisms for acquiring protective overgarments were identified. Participating in process action teams resolved these systemic deficiencies.

2-4. ENTOMOLOGY.

a. LTC Michael Hastriter, Entomological Sciences Division, anticipated that venomous snakes might be a threat to field troops. He compiled a practical treatise on venomous snakes for information purposes in September 1990. Information was extracted from Poisindex, Micromedex, Inc., Vol. 65 (author David R. Brown, M.D.). Treatise included snake bionomics, clinical and treatment aspects of envenomization, and antivenom availability. **Impact:** Data were provided to theater medical personnel via the entomology consultant to the Office of The Surgeon General.

b. Mr. Kenneth L. Olds, Entomological Sciences Division, provided a comprehensive listing of Department of Defense contingency pesticides that could potentially trigger chemical agent monitors, if used as insect control agents in tactical operational areas within the theater, 13 September - 10 October 1990. Data gaps were identified for unknown reactions of chemical monitor systems with specific chemicals, and coordinations were made to provide the questionable pesticides for testing. **Impact:** Identification of contingency repellents and pesticides and their questionable effects on chemical monitors assisted the Armed Forces Pest Management Board in testing chemical detection systems and providing operational guidelines for field use to prevent arthropod-borne disease, while not eliciting false chemical alarm responses.

c. Mr. Brian C. Zeichner, Entomological Sciences Division, summarized available data on house fly and mosquito resistance to insecticides and provided the data to preventive medicine assets in Saudi Arabia. Extensive use of such pesticides as DDT (no longer registered in the U.S. but extensively used overseas) and Malathion to control these insects has produced significant resistance.

Impact: Such historical information on resistance trends in house flies translates to other closely related filth fly species noted to be a serious problem in the area. These data will aid in selecting the most efficacious pesticides to control filth flies and mosquitoes as necessary.

d. Mr. Brian C. Zeichner, Entomological Sciences Division, provided data on body lice and potential lindane resistance 21 January - 4 February 1991. Lindane is the only insecticide in the DOD supply system that is registered for mass delousing of personnel. The World Health Organization has documented body lice resistance to lindane in Egypt, Syria, Turkey, and Iran. Although no records of resistance have been noted in Saudi Arabia, Iraq, or Kuwait, the potential exists. The division provided simple field expedient diagnostic dose test kits to the 714th Medical Detachment for testing body lice found on indigenous personnel. Alternate pesticides to control body lice to include Middle East sources and points of contact in Riyadh were also identified. **Impact:** It is anticipated that huge numbers of refugees/prisoners of war may require delousing on a massive scale. Attempts to conduct such an operation with a chemical to which the body lice have developed resistance would be costly and potentially ineffective. Test kits will facilitate selection of the most efficacious pesticide and local sources provide alternate selection in case of resistance to lindane.

2-5. INDUSTRIAL HYGIENE.

a. Sergeant Lynn B. Whittern, Environmental Health Engineering Division, USAEHA-South, provided industrial hygiene services to monitor operations at Pine Bluff Arsenal, Arkansas. Opening of additional lines due to ODS also required evaluations of engineering controls. **Impact:** Verification of adequate engineering controls on inactive lines and personnel monitoring allowed those lines to be activated to support ODS without jeopardizing employee health and safety.

b. Mr. Osborne E. Goodall, Environmental Health Engineering Division, USAEHA-North, provided a quick response 1-5 October 1990 to U.S. Army Forces Command, due to an increase in painting for ODS. Three of four booths at Fort Devens, Massachusetts, were in operation, none of

which met regulatory requirements for ventilation. Personal protective equipment was not approved. **Impact:** Proper recommendations were made which saved the Army potential worker compensation claims.

c. Mr. John J. Serocki, Environmental Health Engineering Division, USAEHA-North, conducted a survey of spray painting operations at Letterkenny Army Depot, Pennsylvania, 1-5 October 1990. Two booths were placed into operation, neither of which met regulatory requirements for ventilation. New vent system design was required. **Impact:** Proper recommendations were made which saved the Army potential worker compensation claims.

d. Ms. Toni A. Bishop, Radiological and Inorganic Chemistry Division, analyzed two air samples for lead at Pine Bluff Arsenal, Pine Bluff, Arkansas, 18-20 September 1990. Workers were getting sick painting nose ends of rockets. **Impact:** Air samples were below the threshold limit value for lead.

e. Ms. Toni A. Bishop, Radiological and Inorganic Chemistry Division, analyzed ten water and two air samples for lead at Fort Leonard Wood, Missouri, 4-15 October 1990. Workers were getting sick and being monitored for elevated blood lead concentration. **Impact:** The lead results were within safe limits.

f. Mr. Osborne E. Goodall, Environmental Health Engineering Division, USAEHA-North, conducted a study of the firing range at the Bayonne Military Ocean Terminal, New Jersey, 29 October - 1 November 1990. A smoke candle test of the airflow pattern in the range revealed strong turbulence and backflow characteristics at the top of the range at the baffle area. This was caused by nonuniform airflow supplied to the range thru the two makeup air grills. Recommendations were made to achieve a more uniform flow of air by providing a plenum to evenly distribute the makeup air across the firing line and mechanically reducing the revolutions-per-minute of the makeup air fans to a level that will provide at least 50 fpm across the firing line. **Impact:** Outlined requirements for properly designing a firing range ventilation system that would minimize user exposure to airborne contaminants.

g. Mr. Glenn T. Berckman, Environmental Health Engineering Division, USAEHA-North, conducted studies at the 94th ARC, in Rhode Island

and Massachusetts, 13-16 November 1990.

Impact: Corrections improved work conditions for employees and prevented a potential for worker compensation claims.

h. Mr. Osborne E. Goodall, Environmental Health Engineering Division, USAEHA-North, studied fuel handling at Fort Indiantown Gap, Pennsylvania, 13-16 November 1990. An increase in reservists prior to leaving for the Middle East increased the amounts of fuel being pumped for tactical and nontactical vehicles. The potential for exposure to gasoline vapors was greatly increased. Sample results showed the fuel point operators were not subjected to overexposures at this time.

Impact: Prevented possible worker complaints.

i. 2LT Beth A. Bradford, Environmental Health Engineering Division, USAEHA-North, studied CARC painting and welding at Fort Drum, New York, 10-14 December 1990. **Impact:** Good industrial hygiene practices were recommended.

j. The Directorate of Industrial Hygiene participated as follows:

(1) Several documents on sanitation and hygiene topics were prepared for the Kuwaiti Emergency Relief and Recovery Program. These documents were prepared for the 352nd Civil Affairs Command. Input was also provided for the development of the Preventive Medicine Training Packet compiled by the Academy of Health Sciences.

(2) Approximately \$20,000 of industrial hygiene sampling and monitoring equipment, as well as computer equipment, was shipped to industrial hygienists in Saudi Arabia. The equipment was used to ensure that military and civilian workers were not exposed unnecessarily to occupational and environmental hazards from military industrial operations. Approximately \$42,000 of industrial hygiene equipment was sent to the 10th Medical Laboratory, Germany, to support their increased workplace monitoring requirements due to the greatly expanded maintenance operations needed to support the deployment of forces from Germany. **Impact:** The use of the equipment assisted in the necessary industrial hygiene practices.

2-6. LABORATORY SUPPORT. Laboratory support provided by the Analytical Quality Assurance Division consisted primarily of the following:

a. The procurement and shipment of sampling media and/or containers for monitoring operations conducted in support of ODS. The operations included diverse geographical locations other than the theater of operations such as CONUS and OCONUS Army installations, depots, and hospitals involved with troop deployment actions or material readiness (i.e., vehicle repainting, refitting).

b. Shipment, receipt, processing analyses and data reporting of actual samples from the theater and the related support operations conducted elsewhere.

2-7. NONIONIZING RADIATION PROTECTION.

a. Mr. James K. Franks, Laser Microwave Division, conducted an Optical Radiation Hazard Evaluation of a missile countermeasure device for the Communications and Electronics Command, Fort Monmouth, New Jersey, January 1991.

Impact: Evaluation resulted in achievement of a critically needed defense capability for U.S. ground forces, ODS.

b. Mr. James K. Franks, Laser Microwave Division, conducted a laser hazard evaluation of foreign military equipment for the Foreign Science and Technology Center, Charlottesville, Virginia, November 1990 - January 1991. **Impact:** Results of this evaluation are classified; however, information obtained was used by ground forces during ODS.

c. David H. Sliney, Rodney Wood, Patrick Moscato, and Shawn Sparks, Laser Microwave Division, conducted an evaluation of developmental and special laser eye protectors for U.S. Forces, ODS for the U.S. Army Medical Research and Development Command, Fort Detrick, Maryland, August 1990 - January 1991. **Impact:** These evaluations provided assurance that laser eye protectors met specified protective requirements.

d. David H. Sliney, Rodney Wood, Patrick Moscato, and Shawn Sparks, evaluated developmental and special laser eye protectors for U.S. Forces, ODS, for the U.S. Army Natick Research, Development and Engineering Center, Natick, Massachusetts, August 1990 - January 1991. **Impact:** These evaluations provided assurance that laser eye protectors met specified protective requirements.

e. David H. Sliney, Laser Microwave Division, conducted a consultation to provide recommendation of minimum Solar Protective Factor required for sunscreen lotion to be used by U.S. Forces, ODS. The Office of The Surgeon General requested the study in August 1990. **Impact:** Recommendations were used by HQDA (Logistics) to prepare specifications for mass purchase of sunscreen lotion.

f. Mr. James K. Franks, Laser Microwave Division, provided an optical radiation hazard evaluation of test equipment for threat detection system for the Communications and Electronics Command, Fort Monmouth, NJ, in December 1990. **Impact:** Evaluation resulted in achievement of a critically needed defense capability for ODS aviation assets.

2-8. TRAINING - PREVENTIVE MEDICINE.

a. Specialist Anthony Gilmore, USAEHA-South, supported the Health Clinic Medical Laboratory, Fort McPherson, Georgia. The Health Clinic was required to draw blood for HIV analysis on a large number of personnel. SPC Gilmore volunteered to work after normal duty and on nonduty days. **Impact:** Due to understaffing in the clinic, SPC Gilmore's voluntary duty helped them accomplish their mission.

b. Major Alfred L. Hoch and Captain Raymond Dunton, Entomological Sciences Division, attached to the Academy of Health Sciences, served as instructors on the HSC ODS Preventive Medicine Teaching Team. They taught field medical zoology relating to arthropod-borne diseases, venomous arthropods, and medically significant vertebrates. They visited seven installations and briefed 13 medical units totaling 1,000 people from 15 August - 24 September 1990. Captain Dunton provided additional training to local units 1 November 1990 - 20 January 1991.

Impact: Disease prevention and personal protection.

c. Captain Thomas M. Burroughs, Entomological Sciences Division, and 2LT Timothy G. Bosetti, Environmental Health Engineering Division, USAEHA-North, conducted a series of medical threat briefings to deploying units, November 1990 to February 1991. Medical

intelligence from official sources was drawn together and summarized in order to present mission-oriented instruction, emphasizing unit and individual preventive medicine countermeasures, field sanitation and personal hygiene. These one-hour briefings were often presented on a quick response basis. **Impact:** These briefings filled a void in the predeployment training for First Army units mobilizing at Fort George G. Meade, Maryland. These briefings reduced the incidence of disease nonbattle injury incurred within these units and conserved their fighting strength.

d. Captain Raymond F. Dunton, Entomological Sciences Division, 1 November 1990 - 20 January 1991, provided training to two local units and one U.S. Army Reserve Hospital on medical zoology as it related to arthropod-borne diseases, venomous arthropods, and medically significant vertebrates. Personnel from these units were in predeployment status to Saudi. **Impact:** The training was invaluable for disease prevention and personal protection.

e. Major Michael Testa, Chief, Sanitation and Hygiene Office, participated as an instructor for the Academy of Health Sciences preventive medicine training team for one month. The team was responsible for providing a 6-hour block of instruction to deployable medical units on the preventive medicine and chemical threat in the theater of operations. USAEHA was also tasked to offer assistance to Fort Knox, Kentucky, preventive medicine activity. With the increased workload in establishing casualty replacement centers and associated support services, and the reduced preventive medicine manpower, the environmental health mission for Fort Knox was amplified beyond their capabilities. LT Dwight L. Rickard, Sanitation and Hygiene Office, assisted Fort Knox.

f. Training included preventive medicine measures/field medical threat briefings and operational concept of preventive medicine support in a theater of operations. It was conducted within USAEHA, to other tenant units on APG, and to U.S. Army Reserve units processing through APG and Fort George G. Meade, Maryland. **Impact:** This training alerted the deployed personnel on current preventive medicine practices and provided appropriate reference material.

2-9. WATER.

a. Ms. Toni A. Bishop, Radiological and Inorganic Chemistry Division, conducted analyses of raw, brackish and product waters for the U.S. Army Tank Automotive Command, 30 October - 29 November 1990. Eight raw and brackish waters for primary and secondary drinking water metals for reverse osmosis treatment were analyzed.

Impact: The toxic metal results were below established MCLs.

b. Ms. Kathleen W. Simmers, Water Quality Engineering Division, developed a test method for collapsible tank fabrics for the Belvoir Research, Development and Engineering Center, Virginia, 15 June 1988 - 31 July 1990. The testing procedures are used to identify harmful organic compounds which may be leaching from fabric material or bonding resins into the potable water stored in the containers. The test procedures developed are easy to use, require minimal support and reflect Food and Drug Administration/National Sanitation Foundation requirements. **Impact:** Assisted in the testing and fielding of fabric water storage tanks used in ODS. Testing can also reduce taste problems associated with fabric tanks.

c. Mr. Thomas R. Runyon, Water Quality Engineering Division, provided oversight on the Water Quality Analysis Unit - purification test and evaluation plan for Belvoir Research, Development and Engineering Center, Virginia, 1988 - February 1991. This equipment replaces current Water Quality Analysis Unit-Engineer kits. The kit will be used by Quartermaster personnel in their operation of the Reverse Osmosis Water Purification Unit and by preventive medicine detachments. This kit is currently undergoing operational testing. **Impact:** Selected components from the kit were used in ODS.

d. Mr. Thomas R. Runyon, Water Quality Engineering Division, studied field water standards, 1988 - February 1991. This Agency was the lead agency in the tri-services working group which was responsible for the development and evaluation of the field drinking water standards for non-agent parameters based on military specific health criteria. These standards were accepted by the WRMAF and implemented by all services prior to the start of ODS. **Impact:** Without this work, current field water standards would not have

been available for use by medical and quartermaster units to ensure a healthy water supply during ODS.

e. Mr. Thomas R. Runyon, Water Quality Engineering Division, provided medical technical assistance to Belvoir Research, Development and Engineering Center, Virginia, 1989 - February 1991. The study involved the development and initial field testing of the 3,000 gph Reverse Osmosis Water Purification Unit. The sampling protocol for the medical evaluation of this equipment which was used to test the equipment was developed. **Impact:** The 3000 gph ROWPU was deployed as part of ODS without completing operational testing.

f. Mr. Thomas R. Runyon, Water Quality Engineering Division, provided assistance to the Office of The Surgeon General in August 1990. Potable water monitoring requirements and equipment for use by preventive medicine units deployed in ODS were identified which enabled OTSG to minimize the number of nonstandard test kits purchased and used. This was a one time buy to meet current equipment shortfalls. **Impact:** This enabled the preventive medicine units to provide the best possible field water surveillance and ensure a healthy water supply.

g. Mr. Jerry A. Valcik, Water Quality Engineering Division, provided a desk top review of potable water supply systems at 15 Army Materiel Command installations, August-September 1990. This was done to identify environmental stoppers or hindrances in the event that AMC activated these facilities. **Impact:** This review identified installation specific problem areas and defined the magnitude of the corrective measures required to prepare the activity in the event of mobilization.

h. Ms. Toni A. Bishop, Radiological and Inorganic chemistry Division, conducted analyses supporting conversion of tanker trucks for the U.S. Army Tank Automotive Command, 6-11 September 1990. Five water samples for primary and secondary drinking water metals for evaluating POL tankers as potable water supply tanks for troops were analyzed. **Impact:** The water, with respect to metals contaminants, was shown to be safe.

i. Captain Michael F. LaDuc, Water Quality Engineering Division, provided analytical support for the U.S. Army Tank Automotive Command,

11 September 1990. Support was for a project to evaluate a prototype tanker to be converted for transportation of potable water to the troops in the Middle East. Sixty-five analyses were performed on five treated water samples. Parameters analyzed included chloride, cyanide, color, conductivity, fluoride, MBAS, nitrate/nitrite, pH, total phosphate, sulfate, total alkalinity, total dissolved solids, and turbidity. **Impact:** No significant contamination was discovered with regard to the parameters analyzed.

j. Captain Michael F. LaDuc, Mr. Thomas R. Runyon, and 2LT Paul R. Rawlins, Water Quality Engineering Division, provided consultative assistance and site visits to the 5,000 gallon POL tanker production facility, U.S. Army Tank Automotive Command, September-December 1990. This was done to identify health concerns with the conversion of POL tanks to potable water tankers. Based on USAEHA assistance conversion of POL tankers was not feasible. The POL tanker production facilities were modified to manufacture potable water tanks (i.e., tankers designed for potable water use only). **Impact:** Tanker production began January 1991 with immediate shipment to ODS. These tankers will change U.S. Army logistics doctrine for water supply.

k. Mr. Richard M. Valdivia, Water Quality Engineering Division, requested analysis of drinking water on 3 December 1990. Eight water samples as part of an evaluation of a reverse osmosis system for the purification of drinking water in the field were analyzed. Parameters included chloride, conductivity, nitrate/nitrite, pH, sulfate, total dissolved solids, and turbidity (56 analyses). **Impact:** Samples were taken to evaluate and optimize operation of reverse osmosis system being used in the field of ODS. The project was required in order to assure that adequate drinking water was available for the troops.

l. J. Howard Vinopal, PhD, Organic Environmental Chemistry Division, provided assistance in providing methods and standards for the determination of pesticides in drinking water for the U.S. Central Command, 22 February 1991. **Impact:** This assistance permitted the preventive medicine staff in Riyadh to verify the quality of drinking water in the ODS theater.

m. Mr. Thomas R. Runyon, Water Quality Engineering Division, conducted a study for the

Belvoir Research, Development and Engineering Center, Virginia, to determine if any toxic chemicals leak into drinking water from patch/adhesive used to repair water bladder storage containers. These containers were used in Saudi Arabia and elsewhere, but the patch kits have not been evaluated by the Army. **Impact:** Determination if toxic chemicals leak into drinking water in ODS.

2-10. WEAPONS.

a. Mr. William O. Siller, Laser Microwave Division, and personnel from Health Hazards Assessment Office, were involved in weapons system development support from April-July 1984. A limited health hazard assessment report, addressing nonionizing radiation aspects, was completed on the Patriot in 1984. Specific recommendations for engineering and administrative controls to protect operators and maintainers from excessive exposure to nonionizing radiation were provided in the Health Hazard Assessment Report (HHAR). Recommendations included conducting a comprehensive assessment of the other relevant issues (e.g., acoustical energy and combustion products). **Impact:** Patriot crewmembers can conduct their air defense mission without being excessively exposed to nonionizing radiation.

b. Studies were conducted on the Nuclear Biological and Chemical Reconnaissance System (NBCRS). This request came from the U.S. Army Chemical Research, Development and Engineering Center, APG, Maryland during the time frame of April-June 1986, August-October 1987, November 1988-March 1989, and September-December 1990. Personnel included Robert A. Gross, Health Hazards Assessment Office; Joseph A. Macko, Jr. and Mark W. Mitchie, Toxicology Division; William W. Corbin, Jr., Bio-Acoustics Division; Allen E. Hilsmier, Health Physics Division; Wesley J. Marshall, Terry L. Lyon, and Juergen Brammer, Laser Microwave Division; Kenneth E. Williams, Organic Environmental Chemistry Division; and Douglas R. Escoriza, Industrial Hygiene Division. An initial HHAR supported the Source Selection Evaluation Board, and updated the HHAR once the selection was made. The NBCRS, or "Fox," was shipped directly from the assembly line to Saudi Arabia. The Fox, able to detect,

analyze, and mark NBC contamination, was a significant asset in combating the chemical threat during ODS. Impact: By being involved in the acquisition process before, during, and after selection on this nondevelopmental item system, we were able to insure that the hazards to Fox operators and maintainers were minimized.

c. The Cartridge, 105 mm Armor-Piercing, fin-stabilized, discarding sabot with tracer, XM900E1, was evaluated in March-May 1985, June-November 1989, and December 1989 - November 1990, at the request of the U.S. Army Armament Research, Development, and Engineering Center. Personnel involved Major James L. Fleming and Captain Richard W. Lachiver, Occupational and Environmental Medicine Division; Captain Constance Rosser, Health Physics Division; Mr. Robert A. Gross, Health Hazards Assessment Office; and Felix Z. Sachs, Bio-Acoustics Division.

d. The XM900E1 is a depleted uranium, armor-penetrating round which is used in the Abrams tank. We were in the process of preparing an updated HHAR to support type classification when ODS began. The materiel developer asked us to provide an immediate position since the cartridge was being prepared for shipment to ODS. The materiel developer was advised that the existing provisions for handling/using 105 mm depleted uranium munitions were adequate. Impact: The materiel developer was able to release the XM900E1 for use by tanks crews without being concerned that they would be exposed to conditions which would impair their health and effectiveness.

Section II. CRISIS

The following studies were conducted during the crisis period.

2-11. NONIONIZING RADIATION PROTECTION.

a. Mr. David H. Sliney, Laser Microwave Division, provided technical consultation of a laser exposure to U.S. Forces personnel. Services were requested by Letterman Army Institute of Research in January 1991. Impact: Technical consultation assisted in total evaluation of ODS incident.

b. Wesley J. Marshall and Patrick Moscato, Laser Microwave Division, conducted a laser hazard evaluation of a classified special project for the Chemical Research, Development and Engineering Center, APG, Maryland, in January 1991. Impact: Evaluation resulted in achievement of a critically needed increase in the defense capability of U.S. Forces, ODS, by the President's January Iraqi deadline.

2-12. OIL SPILL. Mr. John T. Paul, Jr. and Ms. Jacqueline Fortune, Toxicology Division, conducted a brief ecological assessment on the Persian Gulf Oil Spill on 18 January 1991, for HSC. Information was provided on the probable physical and chemical fate of the oil, and its potential for bioremediation. Sensitive populations of the biota were indicated which were likely to be adversely affected. Impact: Information showing desirability of protection or remediation of small, but critical pieces of habitat, were provided.

2-13. REBUILDING KUWAIT.

a. The Water Quality Engineering and Waste Disposal Engineering Divisions provided engineering support to Kuwait Task Force Enterprises 20 December 1990 - 10 January 1991 at the request of the 352nd Civil Affairs Command. Extensive consultative support in planning emergency and restorative activities for rebuilding Kuwait were provided. A variety of scenarios were evaluated. Detailed plans were developed and consultative support was provided in the following areas: water production/distribution; wastewater collection/treatment; human waste disposal; and solid, hazardous and medical waste collection and disposal. Impact: The civil affairs personnel responsible for developing restorative plans for their Kuwait counterparts had limited working knowledge in the areas listed. We were able to provide the required information with emphasis on the medical threat.

b. Kuwait City Post-Occupation Insect and Rodent Control Plan was developed by Mr. Richard D. Wells, Captain Raymond F. Dunton, and LT Sandra L. Alvey, Entomological Sciences Division, 4-31 January 1991. The requestor was the 352nd Civil Affairs Command. The document will assist in restoration of Kuwait City following withdrawal

of Iraqi Forces. It provided a basis for resource (personnel, equipment, chemicals) planning to control insect and rodent infestations from Kuwait City. Impact: The plan will greatly enhance the ability of the Kuwaiti people to reestablish their living standards with minimal outbreaks of arthropod-borne diseases.

Section III. PERSONNEL DEPLOYED TO SAUDI

2-14. SPC STEPHEN BELL.

Entomological Sciences Division
USAEHA-South

Assigned to: 12th Medical Detachment

ARCENT

APO NY 09772

Assignment: Preventive Medicine Specialist

Date: 11 February - 22 August 1991



2-25. LT GERALD FOREST.

Industrial Hygiene Division

Assigned to: 105th Medical Detachment

ARCENT 173rd Medical Group

APO NY 09616

Assignment: Environmental Science Officer

Date: 9 September 1990 - 30 March 1991



2-16. CAPTAIN DONALD GONGaware.

Air Pollution Engineering Division

Assigned to: 122nd Medical Detachment

ATTN: 105th Medical Detachment

APO NY 09616

Assignment: Sanitary Engineer

Date: 17 February - December 1991



2-17. MAJOR DAVID L. JOHNSON.

Chief, Installation Industrial
Hygiene Management Office

Assigned to: 74th Medical Detachment

44th Med Bde

APO NY 09657

Assignment: Executive Officer,
PVT MED AM HQ Det

Date: 27 August 1990 - 18 April 1991



2-18. SFC(P) KONRAD S. KAROLCZUK.

NCOIC, USAEHA-South

Assigned to: 332nd Med Bde

4th Med Det

APO NY 09698

Assignment: Preventive Medicine NCO

Date: 21 December 1990 - 11 May 1991



2-19. SPC MICHELLE McINTOSH.

Radiological and Inorganic Chemistry Division

Assigned to: 86th EVAC Hosp (A3)

APO NY 09734

Assignment: Laboratory Technician

Date: 16 January - 17 April 1991



2-20. CPL KERRY O. MCKINLEY.

USAEHA-West

Assigned to: HHD, 2nd Bn, Special Forces (Gp(a)
101st Airborne Div (AA)
APO NY 09309

Assignment: Medical Specialist

Date: 23 September 1990 - 23 March 1991



2-21. CAPTAIN M. DEBORAH PARKER.

Occupational and Environmental Medicine Division

Assigned to: 60th AES (AECE)
U.S. CENTAF Fwd
APO NY 09852

Assignment: Flight nurse

Date: 27 August 1990 - 7 April 1991



2-22. LTC L.D. SOLVERSON.

Occupational and Environmental Medicine Division

Assigned to: 85th EVAC Hosp
APO NY 90616

Assignment: Optometry Officer

Date: 12 December 1990 - 22 April 1991



2-23. MAJOR BRIAN J. HILL.

Bio-Acoustics Division

Assigned to: 1st Audiology Detachment
85th EVAC Hospital
APO NY 90616

Assignment: Audiologist

Date: 31 March - 1 June 1991



2-24. CAPTAIN JOAN DAVIS.

USAEHA-South

Assigned to: 714th Med Det
85th EVAC Hospital
APO NY 90616

Assignment: Entomologist

Date: 10 August 1990 - 17 January 1991



Section IV. EXPERIENCES/ LESSONS LEARNED

2-25. AUDIOLOGY TASK FORCE.

By: Major Brian J. Hill
Bio-Acoustics Division

a. An Audiology Task Force consisting of 12 military audiologists were deployed. The Task Force was successful in providing hearing tests in the theater of operations for 29,000 redeploying soldiers after ODS. Six different evacuation hospitals were conducting physical examinations throughout Saudi Arabia when this unit arrived. In addition, soldiers were assembled in the vicinity of three airports (Khahran, King Fhad International, and King Khalid Military City) prior to flying home. To provide services at these sites, the Task Force was organized into teams (1 officer, 2-3 medics per MOHV) which could be tasked to function independently or in conjunction with another MOHV. Ten MOHVs had been flown to Dhahran, but the heaviest concentration of troops was at King Khalid Military City, approximately 400 miles away (via the safety route of travel).

b. Medical units in SWA had already begun to perform physical examinations in Saudi Arabia, Iraq and Kuwait prior to the deployment of this Task Force. While many soldiers consequently returned home without audiometric testing when evacuation hospitals stopped performing physical examinations in early May, this unit ultimately performed 6,500 hearing tests in theater for soldiers who had already received physical examinations, but lacked hearing tests. By completing the hearing tests in theater, the processing of soldiers through CONUS demobilization centers was accelerated.

c. An official report was submitted to the Office of The Surgeon General.

2-26. INDUSTRIAL HYGIENE.

By: LT Gerald Forest
Industrial Hygiene Division

a. I deployed with the 105th Medical Detachment (Med Det), a water quality engineering unit (LC Team) comprised of 3 officers and 16

enlisted personnel. This unit is based at Fort Lewis, Washington, under the "peacetime" command of the 62nd Medical Group.

b. The 105th Med Det was deployed to Saudi Arabia 10 October 1991 and initially resided at Cement City near the city of Dammam. Our brigade headquarters for the first three months was the 44th Medical Brigade under the 18th Airborne Corps.

c. After receiving our equipment from the ship, we immediately assessed the overall sanitation conditions of the numerous unit camps which were sprouting as more troops came into country. We noticed problems with the field sanitation of the transient camps, such as Cement City, Tent City, and the Dammam ports. Potable water was not initially a problem due to the wide use of locally bottled water supplies.

d. The 105th Med Det's second residence was in a newly built hospital, known as the "White Hospital" which had not been occupied since completion of its construction. Our main focus continued to be the more than 80 unit campsites set up in the rear area of the theater (Dhahran, Dammam and Khobar regions).

e. We also placed mission emphasis on industrial hygiene concerns with Chemical Agent Resistant Coating (CARC) painting ground military vehicles in "Desert Sand" color. In addition, we conducted industrial hygiene and safety surveys of all direct support and general support maintenance units within the rear area. Such surveys included an evaluation of the M1A1 Abrams Tank modification operation.

f. Our unit continued to monitor the transient camps. We expanded our responsibilities to include the inspection of major dining facilities that serviced thousands of troops a week. During this time frame, we assisted the evacuation hospitals in setting up their fairly new Deployable Medical System (DEPMEDS) potable water units.

g. After approximately 30 days of conducting work out of the "White Hospital," our residence changed to a large apartment complex called Khobar Towers. Our mission objective was then broadened due to our transfer from the 18th Airborne Corps to Echelons Above Corps (EAC).

h. This change in Corps commands increased our area of responsibility to include the northeast corner of Saudi Arabia. The EAC's Engineer Brigade requested our unit's assistance in the

design of the waste distribution system for the Enemy Prisoner of War camps. These four camps were located in east and west central Saudi Arabia.

i. Immediately after the conclusion of the ground war, a Kuwait Task Force (KTF) was organized to assess and control different critical issues, such as preventive medicine (PM), medical care support and engineering utilities.

j. COL Charles Kenison, sanitary engineering consultant for the Medical Command (MEDCOM), headed the PM section of the KTF. A small element of the 105th Med Det, which included me, headed up to Kuwait in support of the KTF.

k. Our mission began approximately 24 hours after the last battle at the Kuwait International Airport. That mission was to evaluate the potable water and general sanitation of Kuwait City and the surrounding populated areas. Such an evaluation required our entering million-gallon water storage reservoirs which still held live ordnance set up by Iraqi soldiers for sabotage purposes. Meanwhile, our rear detachment was providing PM support to the two Enemy Prisoner of War Camps which swelled with thousands of Iraqi prisoners within a couple of days after the beginning of the ground war.

l. Upon returning to the rear area, the 105th Med Det was notified that they would be included in the first wave of unit redeployments. Our equipment was packed and loaded approximately a week after our notification.

m. In late March 1991, our unit was flying back to the States with the "quite popular" 32nd Air Defense Artillery (ADA) Division (Scud Busters). During our flight, I asked one of the 32nd ADA soldiers if he had seen one of our famous PM messages which appeared on many of the wooden latrines throughout Saudi Arabia. His answer was yes, and that message was:

**THE FLIES THAT FROLIC
IN YOUR FECES
TODAY
WILL DANCE ON YOUR DINNER
TOMORROW!**

CLOSE THE LID!!

Compliments of the
105th Med Det



LT Forest in one of the many wooden latrines.

n. It's ironic that out of all the 105th Med Det's accomplishments during Desert Shield/Storm/Calm, the soldiers remembered a microscopic portion of our mission. However, the more I think about it, if PM is effectively introduced and implemented, there should be no PM problems to talk about. Thus, we and the other deployed PM units have done our job successfully!

2-27. PREVENTIVE MEDICINE (IH) SUPPORT IN SAUDI ARABIA QUESTIONNAIRE.

By: LT Gerald Forest

As I was going through my files, I came across an IH support questionnaire for Saudi Arabia. MAJ(P) Bratt had sent it to me after I had returned from our water survey in Kuwait with COL Kenison. Environmental Science Officers and Sanitary Engineers usually deal with field sanitation, water, wastewater and food quality during large troop mobilizations. This questionnaire will give you an idea of what other aspects of preventive medicine were addressed during ODS.

1. Have you or other folks been involved in any IH problems?

Yes, LTC Thomas D. Murphy, MAJ David L. Johnson, and myself.

2. What is the priority of IH problems within the theater?

If it had an immediate effect on a person's health, then a very high priority was placed on the IH problem. For example, a CARC spray painting incident had reached as high as the Army Central Command (ARCENT) Commander after which an immediate evaluation was requested. The degree of urgency was due to the importance of the theater vehicle painting mission.

3. What kinds of IH problems are you seeing? (welding, painting, engineering controls, confined space work, etc.)

LTC Vincent R. Sherman, Commander of the 105th Medical Detachment during the deployment, and I investigated a "possible" hazardous waste site where some of the troops exhibited symptoms of dizziness, headaches, and nausea while conducting sandbagging operations.

I evaluated an aircraft noise concern at the 85th Evacuation Hospital located at Dhahran International Airport. I also evaluated an IH concern of some possible asbestos dust at a well known troop holding facility in Cement City located right outside of Dammam. This location was a cement pipe construction company suspected of using asbestos during their operation. In addition, I evaluated the "famous" maintenance expandable trailers that have known asbestos in their ventilation ducts.

MAJ Johnson evaluated the health effects of diesel fuel placed on ground surfaces to control dust. He also evaluated the fuel handlers' exposure to petroleum products especially during high ambient temperatures. I don't believe any sampling was conducted for this evaluation.

LTC Murphy investigated the CARC paint incident where some of the personnel conducting a paint mixing operation exhibited symptoms similar to isocyanide exposure (See Attachment 1). LTC Murphy was also involved in the environmental air sampling of the burning oil wells in Kuwait.

These were the major IH problems that occurred during my deployment period (Oct 90 - Mar 91)

4. What kinds of operations are presenting problems? (maintenance, communications, etc.)

The painting incident falls under the category of a maintenance (occupational) problem. The other IH problems were more of an environmental generated concern, more so than your typical IH problem created by occupational operations.

5. What kinds of medical problems that could be related to occupational health are you seeing? (noncombat heat stress, respiratory, dermal, ergonomics, etc.)

The only problems that I was aware of were the ones associated with the sandbagging and painting operations (i.e., nausea, dizziness, headaches, and rash).

6. Are they real problems or perceived problems?

These problems were presumed to be real after the affected personnel were evaluated by physicians.

7. Where are the problems located? [Echelons Above Corps (EAC), Corps, Division, Brigades, Battalions, Companies, etc.]

The painting incident was a maintenance company under EAC. The sandbagging operation was a signal battalion under 18th Airborne Corps. I'm not sure of the unit origins for the diesel and fuel handling evaluations.

8. What kinds of work schedules are occurring in the combat support and Combat Service Support (CSS) arena?

I'm not quite sure, I've seen 8-12 hour shifts for CSS here in the rear and some of the forward maintenance elements.

9. Was any sampling performed?

Yes, noise sampling for the 85th Evacuation Hospital (Dhahran Airport) using a direct reading device and bulk soil samples were taken for asbestos fibers at the troop holding facility. Bulk samples were also collected for the expandable vans. LTC Murphy conducted air sampling in Kuwait, however I don't know the details of his evaluation.

10. Are TWA/TLV's being determined or are you working worst case measurements and seeing if these are below standards?

The Army Hearing Protection Standard was used for the noise evaluation of the Evacuation Hospital. The hospital commander was informed that the measurement device that our unit possessed was not the best equipment for evaluating environmental noise as in their case. For the other IH evaluations, no TWA/TLV's were applicable because there was no air sampling conducted in my evaluations nor in MAJ Johnson's. LTC Murphy might be able to shed some light on this question for his air sampling in Kuwait.

11. What standards do you feel are appropriate in combat zones?

At this moment I can't recall any standards that I think are appropriate in combat zones. But I feel that the current standards are goals to shoot for even though at times it's almost impossible to conform to the standards that are used in a garrison environment. Case in point is the CARC painting of armor vehicles where I believe OSHA and EPA would have had a "Hay Day" with the painting set up that they had established at the Dammam Port. I believe LTC Murphy and MAJ Johnson would concur! However, our goal is to strive towards the applicable standards over time given the equipment, supplies, and personnel available during the mission. Now granted I don't believe that this painting operation would eventually include a high speed laminar flow paint booth because of the operation's duration in country. However, as stated before, that is our inevitable goal.

12. Do we need to develop field standards?

As stated above, I feel we can strive for the current standards; however, from a legality standpoint it would behoove us to have field standards for painting, welding, and basic maintenance operations performed in the field. I would like to emphasize the word field because some of our major operations (i.e., Army Depot located at Saudi Arabia Services Company (SASCO) were located in fixed facilities. I see no reason why current standards cannot be implemented in this type environment especially given the long duration of this large operation.

13. Should the standards be higher or lower?

They should be higher for painting and welding operations. For example, the requirement to use an airline respirator in conjunction with laminar flow paint booth should be reconsidered. I believe there is some controversy over that requirement even in the garrison environment!

14. What type of sampling was performed (direct reading, real time)?

As mentioned earlier in question 9, just real time sampling was conducted for noise evaluations and bulk samples were taken for the asbestos analysis. I'm not sure what type of air sampling LTC Murphy conducted in Kuwait (grab, integrated, etc.).

15. If samples had to be analyzed where would you get your support?

Bulk soil and ventilation duct material samples were sent to 10th Medical Laboratory in Germany. If they were unable to perform the analysis, we requested they utilize USAEHA's services.

16. What types of IH equipment do you have?

I had in my possession the following equipment, which is organic to a preventive medicine detachment:

- Three gas real time monitors (O₂, CO, combustibles)
- Anemometer
- Sound level meter and calibrator
- Two hand sampling pumps and assorted detector tubes
- Light meter
- Smoke tubes
- Tape measure
- Dial thermometer

17. What type of IH equipment are you using?

I've used the sound level meter several times and the gas monitor once. Unfortunately, the gas monitor was not calibrated for carbon monoxide during my evaluation.

18. What types of IH equipment do you need?

The following equipment list is an excerpt of a list MAJ Johnson put together to help support Army Depot facility under AMC. All the requested equipment was received by 12th Preventive Medicine Unit and eventually hand

receipted to me in late Feb 91. Unfortunately, I never had the opportunity to use this equipment due to my excursion up north (Kuwait) and my early redeployment in March 91.

- Gilian air flow calibrator kit (or equivalent) (1)
- Dupont Alpha-1 air pump with charger (or equivalent) (6)
- Dupont Alpha-2 air pump with charger (or equivalent) (6)
- Charging strip, 6 outlet or more (2)
- Extension cord, 25 ft (1)
- Transformer, 220 to 110 volt, 1000 watts (2)
- Tygon tubing, $\frac{1}{4}$ inch (10), 50 ft roll (1)
- Lapel clips, $\frac{1}{4}$ inch (10)
- Matched weight 37 mm CE filter cassettes (50)
- PVC filter cassettes (20)
- Passive dosimeters, organic vapor (30)
- Cassette-to-hose couplers (10)
- Charcoal tubes, large (1 box)
- Charcoal tubes, small (1 box)
- Sorbent tubes, large variety (10 of each)
- Sorbent tubes, small, variety (10 of each)
- Duct tape (2 rolls)
- Respirable dust sampler (miniature cyclone) (3)
- Miniature spillproof impingers (3)
- Pistol belts, large (2), medium (4), and small (2)

19. If equipment had to be repaired, what kind of maintenance support would you be able to get?

Our first approach would be to utilize the communications repair shop at one of these maintenance units. If that wasn't a solution, then we would send the equipment to Germany or to the states for repair/calibration.

20. Are batteries providing problems?

Yes, it has been difficult to replace the battery for the sound level meter calibrator. This is a special cylindrical shaped transistor battery which has a positive and negative connector at opposite ends. Supposedly, it's even difficult to find in the states.

21. Where would you go to get batteries?

If they were available, from the local economy, Germany or CONUS.

22. Has heat affected the performance of IH equipment?

Not yet, however, I haven't operated the equipment during the "HOT" months (June - Sept). LTC Murphy might get the opportunity to use the equipment during those months!

23. What references do you have?

The only reference organic to the unit was the Preventive Medicine 91s Tech Guide. This reference includes an IH section which covers the basics. My personal references were sent to me by LT Kenneth R. Mead. They included the following:

- Fundamentals of Industrial Hygiene (3rd edition)
- ACGIH TLV Booklet '91
- CFR 29, Labor, Parts 1900 to 1910 (1 July 1987)
- AR 11-34, The Army Respiratory Protection Program
- NIOSH Chemical Manual
- TB MED 503, The Army Industrial Hygiene Program
- TG 025, Testing and Calibration of Industrial Hygiene Instruments
- TG 029, Industrial Hygiene Guide Surface Tank Operations
- TG 141, Industrial Hygiene Sampling Instructions
- TG 144, Guidelines for Controlling Health Hazards in Painting Operations
- TG 165, Installation Industrial Hygiene Program Self-Assessment Guide
- Various ACGIH booklets on Ventilation System Testing
- Various NIOSH Welding booklets on Welding Control Systems

24. What references do you use?

- ACGIH TLV Booklet
- NIOSH Chemical Manual
- TG 029
- TG 141
- TG 144
- Fundamentals of Industrial Hygiene

25. What references do you need?

- Patty's Toxicological Guide
- HMIS (Book or CD)

26. What references/guides should we look at developing?

I don't have a response for this question at this time.

27. Do the LB and LC teams have the engineering kits? The Book sets?

Yes for the engineering kits, but no for the book sets. I've talked with the garrison 105th Medical Detachment Commander and he stated they [Pvt Med (PM) team planners] have reduced the book sets (eliminating the IH references) to help increase unit mobility.

28. Are they useful or are they excess baggage?

The engineering kits have been very useful for us because of our rear support area mission. This included support of the AMC, Depot Systems Command (DESCOM) Facility, Material Fielding Team (Tank Modification Plant). The forward PM units (LB teams) would probably find the engineering kits extra baggage because of their mission. MAJ Johnson may have further information if the forward element LB teams have used their engineering equipment.

29. What should be the makeup of the engineering kit? Should a velometer (vane type), microscope (with graticule for field expedient particle analysis), computer with appropriate software, scale, etc. be additions to engineering kit? Looking at how results can be turned around quickly in the field, should we include tin snips, hammer, duct tape and baling wire or items of this nature to correct problems found?

The items listed in question 18 should be included in the engineering kit. I feel that a computer has been beneficial to our unit as far as report generation. I was in the process to set up an Industrial Hygiene Inventory to pattern the HHIM program. I originally requested the HHIM software but didn't receive a response from the Industrial Hygiene Management Office (IHMO). A microscope could be nice if the individuals in our unit had the expertise to use such equipment.

I feel the tin snips and bailing wire are items that can be procured from other sources as proposed to including in the engineering kit.

I would like to reemphasize this modified engineering kit would probably benefit a PM unit that has a rear support mission like ours. It would probably be "excess" baggage for the forward PM units who didn't support large maintenance operations.

30. Is it feasible to develop a handbook/guide on the approach to field expedient?

Yes, but I will have to give this question further thought!

31. Are you recommending engineering controls? Yes.

32. Do you recommend field expedient engineering controls? What are some specific examples?

Yes, placing sandbags around noisy equipment such as portable generators, directing generator exhaust by utilizing PVC piping to elevate the exhaust into the air, moving generators from the area of flammable paint products (Admin Control), etc.

33. What can we reasonably expect of our folks regarding recommendations of quick fixes for problems?

It depends on the extent of the operation that has the problem. Most of the quick fixes are administrative procedures and sometimes proper personal protective equipment (PPE). In the long term we would like to resolve our IH problems using engineering controls, however, the short term solution has been the admin/PPE route.

34. What can we reasonably expect of our folks' recommendations by commanders?

If there was a problem with personnel exhibiting some unhealthy symptoms, then there was usually no problem with commanders implementing our recommendations. The problem with implementation of some of our recommendations was when commanders did not perceive a problem and their personnel were not physically falling out on the job.

35. If construction of something has to be accomplished what organizations at what levels would be involved? Would construct? I guess what I am trying to determine is that in garrison we emphasize the importance of interaction with the CPO, Safety, DEH, Logistics, Resources, etc. Do we need to develop short guide to types of organizations and what they do without reinventing any wheels?

Major construction projects for EAC units are usually handled by the Engineer Brigade [i.e., Waste system for Enemy Prisoner of War (EPW) Camps]. I have noticed that some units have utilized maintenance companies to construct smaller projects (i.e., tire cages, defensive position obstacles). I don't believe that PM or the theater safety officer gets involved with every construction project that takes place in the rear or forward areas. I'm not sure of the organizations that are involved in construction projects; however, we have noticed throughout this deployment that contracted personnel are heavily involved with every aspect of Operation Desert Storm.

36. What is the best way you have found for presentation of recommendations to Commanders?

We have found by just simply telling the commanders or unit representatives what the problem is and discussing the repercussions if a particular problem is not resolved. We try not to dictate regulations or standards to them unless it's an immediately dangerous to life and health (IDLH) situation.

37. Should the PM Field Manual contain industrial hygiene information for Field Environments? (See Attachment 2)

One of my missions was to conduct IH and Safety surveys of all EAC Direct Support and above maintenance units (Rear and Forward elements). The common maintenance operations and hazards, and the type of control for these hazards, were very similar to the list of operations in the HHIM manual.

I have found this useful in teaching the 91S (Pvnt Med Technician) what I'm looking for when conducting these surveys. It might be useful to have this type of information to include common problems implementing these controls (which is pending!), if PM is given such a task in the future.

38. What kinds of personal protective equipment are found at the various types of units?

- Safety glasses
- Welding goggles, hoods, and gloves
- Chemical splash shields
- Air purifying respirators with dust, mist, and fume cartridges
- Air purifying dust respirators (disposable)
- Ear plugs/muffs

39. Are there any problems with the procurement of PPE?

Yes, if a unit goes through the military logistical system it usually takes months to receive a particular item. Most units have a Class A agent and the purchasing officer could easily purchase PPE on the local economy. However, IH&S equipment is usually not at the top of the priority list for items to be purchased.

40. What kinds of PPE is found in the Tool Kit Sets of the Units?

Same as question #38.

41. Should the Tool Kit Sets of Maintenance or other units contain PPE to include respirators if required?

Yes, I have found that most DS and GS units possess air purifying respirators but they are hardly ever used and are kept in poor condition. I feel that welding and solvent use operations need some sort of respirator protection especially working with unknown metals and solvents which is quite common especially when maintenance units procure such materials from the local economy.

42. In order of priority what do you feel the PM folks should have basic understanding of in order to perform an acceptable field expedient IH service? An acceptable PM/Engineering service?

- a. Basic understanding of recognition, evaluation, and control of IH problems.
- b. General knowledge of IH equipment and basic maintenance.
- c. General knowledge of the unit organization (Chain of Command)

These are some areas that initially come to mind.

43. What happens to the data that is collected (referring specifically to personal monitoring and data that should be maintained for historical purposes)?

Currently, the little data that is available is kept in the unit hard copy files.

44. Comments:

I have to honestly admit that I didn't think I would be doing any IH work here in Saudi Arabia. But I eventually found out there was enough IH work here to keep me and a technician busy throughout the two campaigns. The three vehicle painting operations were major projects in the early part of Operation Desert Shield mainly due to the earlier "Painting Incident". Unfortunately this incident was a result of non-communication between the proper consulting personnel (PM and Safety Office) and the users (maintenance battalion).

My IH&S surveys of EAC maintenance units were mainly safety issues than IH problems. Occasionally there were some IH concerns noted during my surveys such as excess noise and carbon monoxide exposures in a field laundry unit, air ambulance maintenance personnel exposure to volatile solvents during dip tank operations, and the list goes on. However, most of the concerns observed were in the safety arena.

The AMC DESCOM Facility was almost at full operation around late December. MAJ Johnson and I conducted initial walk-through of the facility before any personnel or equipment had arrived. I later conducted a preliminary survey searching for areas where they might have potential problems and areas where I would later have to evaluate the effectiveness of their controls (i.e., exhaust ventilation hoses, painting booth ventilation, etc.) At the time of my survey these systems were not operating.

The Dammam Port tank modification plant was a problem because no PM guidance was given during their initial set up phase. The commander did not want to hear that we were going to shut down his major theater operation because of the inadequate painting set up; however, he did listen to our concerns but was slow on the implementation of recommendations. I believe this was partially due to the fact this commander was not directly responsible for the personnel working at his operation.

You probably noticed that I gave general statements during most of your questions. I couldn't get into too many specifics. I gave you responses that immediately came to mind and I am requesting additional time to concentrate on specific examples which should prove to be beneficial in assessing the IH support required for future large deployments. I believe a reference manual would be beneficial for quick recommendations for IH problems.

I also strongly believe that every person should have the opportunity to attend the basic IH course. This will give PM personnel a better feel for what IH is all about and the opportunity to work with the latest IH equipment. I'm well aware that the 91S receive training during their Advanced Individual Training (AIT), however I feel a refresher in this area would not hurt especially when there might be an opportunity to actually use this knowledge during a major operation.

I will be more than willing to discuss in detail my responses to these questions or others you may have upon my return.



LT Forest - approximately 4 miles south of Iraqi border (Saudi Arabia)

Attachment 1

DEPARTMENT OF THE ARMY
12th MEDICAL DETACHMENT (PMW) - OPERATION DESERT SHIELD
APO New York 09616

20 December 1990

MEMORANDUM THRU Commander, 593d Area Support Group, APO New York 09616

FOR Commander, 176th Maintenance Battalion, APO New York 09616

SUBJECT: Industrial Hygiene and Safety Evaluation of "CARC" Painting Operation

1. AUTHORITY. Tasking from ARCENT PMO to evaluate "CARC" Painting Operations conducted by elements of the 176th Maintenance Battalion.

2. BACKGROUND.

On 17-19 December 1990, an industrial hygiene and safety evaluation was conducted in the vicinity of Al Jabayl where the 325th Maintenance company was conducting "CARC" painting operations. The evaluation was performed by LTC Thomas D. Murphy, and outbriefing was held with LTC Blazer and MAJ McGregor on 20 December 1990. The painting operation receives vehicles requiring "CARC" spray painting as they arrive in-country. A priority system exists which identifies what vehicles are to be painted. The production rate can vary widely from 10 vehicles per day to well over 100 vehicles per day depending upon the arrival of vehicles and the functioning of paint spray equipment.

On 17 December 1990, I met with and discussed the "CARC" painting operations with LTC Blazer, Commander of the 176th Maintenance Battalion. I then visited the painting site on 18 December 1990, discussed and evaluated operations with 2LT Westlake and MAJ McGregor. On 19 December 1990 myself and MAJ T. Little (MD) interviewed approximately 20 service members of the 325th Maintenance Company regarding symptoms experienced during painting operations. Later that day the Al Jabayl paint site was revisited and the work practices and procedures that had been implemented were reviewed. Painting operations were not in progress and therefore not observed.

"CARC" painting presents the potential for toxic exposure to unprotected personnel due to the toxicological properties of the paint. Since substitution of a less toxic paint is not practical at this time and engineering controls such as paint spray booth and local exhaust ventilation are not available, the only means of servicemember protection is through the use of personal protective clothing and equipment, work practices, and administrative controls.

3. FINDINGS.

A problem associated with personnel overexposure to "CARC" painting operations at Al Jabayl occurred during the week of December 10. Symptoms indicated that short term (acute) overexposures to some of the solvent carriers as well as to unreacted isocyanates had occurred. No determination as to the possibility of acquired sensitivity to the isocyanate was made.

SUBJECT: Industrial Hygiene and Safety Evaluation of "CARC" Painting Operation

The cause of the overexposure resulted from inadequate engineering controls and inadequate use of appropriate respiratory protection and personal protective clothing.

On 17 December 1990, the Commander of the 176th Maintenance Battalion identified a local source for respiratory protection and protective clothing. These items were delivered to the painting sites on 18 December 1990. I provided instruction on the wearing of the full-face air purifying respirator with acid gas/organic vapor canisters as well as the wearing of other protective equipment. Due to the necessity of providing equipment expeditiously a local vendor dealing with safety supplies was used.

Other control measures were implemented which should help reduce exposure. These controls included establishment of a restricted area within which certain levels of protective clothing would be worn depending upon the specific job, 8-hour work shifts, job rotation, and establishment of a break area removed from the painting site.

4. CONCLUSIONS.

The recent actions taken by the 176th Maintenance Battalion were practical and effectively provided a short term fix in a low production rate setting where possibly up to 50 vehicles per day could be painted. Should a production rate of 100-200+ vehicle per day be required I feel health problems would again surface and additional controls would need to be implemented.

5. RECOMMENDATIONS. Recommendations for a high production rate scenario are provided below:

a. High Production Rate: 100-200+ vehicles per day.

(1) All personnel working in and around the "CARC" painting, and mixing areas would need to be provided a full-face air-line respirator, Tyvek clothing, hand and foot protection.

(2) Assure air-line systems are capable of providing breathing quality air. In this environment the location of the air intakes for the compressors need to be in a protected area or an area as remote as possible from the source of contamination, and filtration systems maintained.

(3) Acquire additional mechanical agitators and/or mixers in order to reduce servicemember exposure due to the manual stirring and mixing of "CARC" paint.

(4) Assure a steady flow of respiratory protective equipment and personal protective equipment is delivered to the paint site. It may be necessary to local purchase needed items should normal supply channels be unable to provide the needed equipment on time.

(5) Place fire extinguishers (B type) designed to extinguish flammable liquid fire in the vicinity of each painting or mixing operation. The solvent carriers for "CARC" paint are flammable.

(6) Continue to enforce the restricted area concept and emphasize the importance of good personnel hygiene among unit members after they have finished painting operations.

(7) Follow to the extent possible the attached safety and health procedures for "CARC" painting operations. (See Attachment A)

SUBJECT: Industrial Hygiene and Safety Evaluation of "CARC" Painting Operation

(8) Our point of contact is LTC T. Murphy should further questions or concerns regarding this operation develop.

Approved By:

THOMAS LITTLE
MAJ, MD
CDR, 12th MED DET

THOMAS D. MURPHY
LTC, MS
12th MED DET

CF:
ARCENT SURGEON
ARCENT PMO

Point of Interest:

LTC Thomas D. Murphy was assigned to USAEHA from 1977-1981 and worked for me as my No. 1 Industrial Hygiene Officer.

GERALD L. DELANEY
Colonel, MS
Deputy Commander
USAEHA

Attachment 2

GENERAL MAINTENANCE OPERATIONS AND IH&S CONCERNS

OPERATIONS	HAZARDS	CONTROLS
Battery Repair	corrosive liquid, H ₂ SO ₄ , vapors	eye/face/hand/garment protection, GEV
Cleaning/Degreasing Tanks/Solvent	vapors, skin and lung irritants	LEV, respiratory/eye/face/ garment protection
Electronic/Radio Repair	fumes, radiation source (M-8 Chem alarm)	respiratory protection, LEV shielding
Engine Test Stand	noise	hearing protection baffles
Generator Repair	noise, CO	LEV, hearing protection
Grinding/Sanding	noise, dust, flying objects	hearing/eye/face protection
Lathing/Milling	noise, flying objects	hearing/eye/face protection
Painting (Spray/Mix)	vapors, mists	LEV, respiratory protection
Refrigeration	lead fumes (soldering)	LEV, respiratory protection

OPERATIONS	HAZARDS	CONTROLS
Sand Blasting	noise, dust, flying objects	LEV, respiratory/eye/face/hearing protection
Vehicle Repair, including Brake Repair	asbestos, CO, falling objects	respiration, wet methods, LEV
Weapons Repair (small arms)	lead dust	respiratory protection, LEV
Welding/Cutting	fumes-CR ₆ , O ₃ , NO ₂ , etc., noise	LEV, respiratory/eye/face protection

2-28. SANITARY ENGINEERING.

By: Major David L. Johnson
Chief, Installation Industrial
Hygiene Management Office

a. Notification and Pre-Deployment Preparation.

(1) I was notified on 26 August 1990 that my name had been submitted to Forces Command (FORSCOM) by the Office of The Surgeon General (OTSG) as a Professional Filler System (PROFIS) candidate for assignment to the 74th Medical Detachment at Fort Benning, Georgia. The 74th is the preventive medicine command and control (AM) team for XVIII Airborne Corps, and when deployed has operational control of several subordinate preventive medicine detachments. I was given 48 hours to report to the unit, and spent the available time outprocessing at Aberdeen Proving Ground, Maryland. COL Charles B. Kenison (former Commander at USAEHA) and I were outprocessing at the same time. He expected to depart for Saudi Arabia immediately after the change of command ceremony at USAEHA. I reported to Fort Benning on 28 August expecting to move out within a week.

(2) We remained at Fort Benning for seven weeks before deploying; as it turned out we needed every day available to get the unit ready. The 74th is an active duty unit maintained at zero-strength unit during peacetime, i.e., the equipment and vehicles are in place but no personnel are assigned. Essentially all of the unit's equipment was damaged or missing and it took seven weeks to acquire replacements. By mid-October, the 74th was ready for deployment with an authorized strength of eight officers and nine enlisted personnel. The officer staff consisted of the commander (a preventive medicine physician), an administrative officer, and six technical consultants in preventive medicine, entomology, sanitary engineering, environmental science, health physics, and veterinary medicine. I was the sanitary engineering consultant.

b. Overseas Deployment and Early Experiences.

(1) Captain Brett Armstrong (health physics consultant) and I left Fort Benning at 2100 on Thursday, 11 October, and arrived at the King Abdul Aziz Air Base in Dhahran, Saudi Arabia at

0500 on Saturday, 13 October. It was a 24-hour flight on a C5-A with stopovers in Westover, Massachusetts and Torrejon, Spain. We acted as the detachment advance party. We took an M1009 CUCV Blazer with us, which was good because there was no support system in place for new arrivals -- it was sort of "Welcome to Saudi. You're on your own." We were relatively lucky, though. One group flew in with their vehicles on the plane, and after unloading were told to park their trucks and wait in a tent. After a time, they came out of the tent and found that their vehicles had been stolen. A lot of procurement by stealth went on early in deployment.

(2) We immediately started driving around the city trying to find the 44th Medical Brigade headquarters, and within 24 hours we knew where the important facilities were. We had a city map, which wasn't easy to use because few streets had street signs, and most of the ones that did have signs were named after one of the Saudi kings. Since there have only been five, there was a lot of redundancy. Lacking signs, the joke was, "Follow this road and turn at the camel by the rock."

(3) The rest of the unit arrived on the morning of 15 October. The 105th Medical Detachment (LC - sanitary engineering), our sanitary engineering team, arrived on the 15th as well. 1LT Gerald Forest was PROFISed to the 105th. The 61st (LB - environmental science), 224th (LB), 227th (LD - epidemiology), 714th (LA - entomology), and 926th (LB) Medical Detachments were already in country, so that the command and control element was essentially the last to arrive. Lack of command and control in the early stages of deployment caused confusion, and preventive medicine coverage wasn't as good as it could have been. We took control as soon as we arrived, and began coordinating the activities of the six subordinate detachments and providing liaison between the detachments and the 44th Medical Brigade headquarters.

(4) Dhahran is a port city on the northeast coast of Saudi Arabia, approximately 200 miles south of Kuwait. There were roughly 20,000 American military personnel living in tent cities in the Dhahran area in mid-October. Most of the Army maneuver units, i.e., battalions of the 82nd Airborne Division, 101st Airborne Division, and 1st Cavalry Division, were still in port awaiting arrival of their equipment. Sanitation conditions in

most camps were horrendous. As usual, preventive medicine had been given little attention until the situation became intolerable. Our consultants inspected a camp soon after our arrival, and blasted it for its overflowing latrines, filthy dumpsters, unsanitary showers, and hazardous food service practices. Within a few days, we were doing an epidemiologic study of a food-borne outbreak of dysentery. A Congressional Inquiry came down from Army Central Command (ARCENT) headquarters in Riyadh, and shortly after that the camp "mayor" was relieved, along with half of his staff. The perception in the tent cities was that the troops lived in hardship while the rear echelon brass lived in villas in Riyadh. Morale was not good in the camps.

(5) CPT Armstrong and I looked at the camps before our unit arrived, and decided to avoid them at all costs. Unfortunately, the best we could come up with was a maintenance shed full of equipment on the 44th Medical Brigade compound, which we were happy to get. The day our troops arrived we spent several hours cleaning out the shed so we could stay there. Jet lagged and dragging butt from their 24-hour flight, everyone in the unit humped junk for 6 hours or so in 100 °F temperatures. A rough introduction to Saudi Arabia! Still, they didn't complain because they had been taken from the airport to one of the camps first and knew what the alternative was. During the first two weeks we gradually refined the place, and became relatively comfortable with the acquisition of cots, electricity, lights, and floor fans. It was practically home sweet home, only with 16 brothers and sisters to share your room! It's surprising how soon you get over a lot of the inhibitions you grow up with, such as changing clothes in a mixed environment. We separated the enlisted women's area from the men's area to minimize stress.

(6) We were kept busy trying to manage the LA team, three LB teams, one LC team, and one LD team. The three LB teams were moved out of Dhahran and into the desert in early November to support corps assets in the division rear areas as the divisions moved to their assembly areas. The LA, LC, and LD teams and the 74th stayed in Dhahran, where most of the corps assets were located.

(7) Saudi Arabia is essentially one huge desert, and even in November the daily high temperatures were still around 100 °F during the day along the coast, and more like 105 ° to 110 °F in the central desert. Not all of the desert is the same, though. I saw at least five kinds of desert, ranging from big sand dunes to rocky hardpan. The only vegetation along the coast was date palms and thorny bushes that the camels grazed. Vegetation became more scarce inland. The really big "Lawrence of Arabia"-type desert is in the Rub al Khali, or the Empty Quarter, in southeast Saudi Arabia, and none of our units were assigned there.

(8) Army personnel, which early in the deployment meant XVIII Airborne Corps personnel, weren't allowed to go downtown to shop or interact with the Saudis in any way for fear that we would offend our hosts, and I felt that it was a good policy (if personally disappointing to me).

(9) General Motors has a big share of the car market in Saudi Arabia, and the most popular models seemed to be the Chevrolet Caprice sedan and the Chevrolet or GMC Suburban. The Japanese are making inroads, though, especially in the small pickup market. The Bedouin are particularly fond of Toyota and Datsun pickups, which are almost always white with an orange stripe down the side. The Japanese supported Desert Shield by donating luxurious Toyota Landcruiser 4-wheel drive vehicles for our use. Most of the Landcruisers were appropriated by the CENTCOM and ARCENT staffers and never made it to the desert. The vehicles will stay in Saudi after we leave and be resold, I presume, to Saudi citizens. Good marketing. Other Japanese contributions included two portable reverse osmosis water purification unit (ROWPU) systems similar to our large ROWPU units, which gave them a foot in the door for the water purification market as well, and a great many Sony televisions and VCRs.

(10) You really can buy just about any name product in Saudi Arabia that you can buy in the States -- the Saudis import almost everything. We had purchasing agents who did our shopping for us, and 1LT Forest was the agent for the 105th. 1LT Forest initially spent most of his time shopping and visiting with the Saudi merchants. He said it takes three hours to buy anything because business is a social event and you can't just rush into it. A

lot of tea has to be sipped and small talk exchanged before getting down to discussing business. My own unit's purchasing officer was MAJ Jim Wilson from Fort Benjamin Harrison, Indiana, and he had a hard time with the custom.

(11) Our main staff of ten persons worked out of one 10 x 12 foot office, and it was incredibly crowded. The rest of the staff worked out of the shed. We didn't complain too loud, though, because our office was an air conditioned building.

(12) I took a laptop personal computer with me, and it was a real treasure to us. We obtained a second system from Fort Benning the day I left, and both were kept busy continually. We had only the two PCs for all seven of our detachments, which really hurt us. Before the war started we were inundated by 44th Brigade Headquarters with requirements for daily reports. Without the two computers we would have been spending a lot of time on typewriters (which tended to burn out because of poor power supplies). Data processing equipment was a critical shortage throughout the Theater for much of the deployment.

(13) ARCENT was the Army component of Central Command, which ran Operation Desert Shield/Storm. ARCENT eventually commanded XVIII Airborne Corps, VII Corps (from Germany), and the Theater Support Command. Until sometime in December, the only preventive medicine support available to units above division level was through XVIII Airborne Corps, which meant our medical detachments. Echelon-above-Corps (EAC) units belonging to ARCENT were provided support upon request, and it took some time to work out procedures for routing requests and responses through the correct official channels. Between the 74th and ARCENT (going up the command chain) were the 44th Medical Brigade, 1st Corps Support Command, and XVIII Airborne Corps headquarters, and we had to be careful that nobody was bypassed.

(14) We stayed busy, usually working 10- or 12-hour days. The work was interesting because we were hit with the spectrum of problems. Terrorist activity was a continual worry, and we received several requests to look at bottles of water that were suspected of having been tampered with (none were), and in one instance we were asked to test water in a water tower for suspected cyanide poisoning (it wasn't). We figured out early on that

there was a misconception about preventive medicine's water analysis capability. The clients thought we could analyze for anything that might be in the water, when in fact we were limited to only a few chemical and physical parameters, a few chemical agents, and coliform bacteria. We suffered a credibility problem when the higher-ups learned how limited we were. We were the "water testers", so obviously we should have had the ability to test for anything. Inability to test for deliberate contaminants became a major concern as the ground war neared.

(15) After five weeks in the shed we moved to a new and much nicer compound. We lived more comfortably there, crowding only 10 to 14 people in three bedroom houses. It was paradise after living in that shed. We even had a TV in our "villa", but the only two English language stations were Saudi and usually had boring programming. The comings and goings of the Saud family are prime news material, and we saw lots of footage of parades, meetings, etc. Reruns of 1970s BBC nature pieces and the like rounded out the entertainment evening.

(16) The King is referred to as "The Keeper of the Two Holy Mosques King Fahed". King Fahed gave some "gift water" to our units in plastic bags, straight from Mecca and delivered in refrigerated vans, but we had a problem. The water was bacteriologically "alive". Six troops drank it and one was hospitalized for four days. Our folks analyzed it at three different labs and found bacteria too numerous to count, but the Saudis did an analysis and found it "100% drinkable". Who was going to tell the King that his Mecca water was polluted? We disposed of the water and politely refused future offers. The whole incident was nearly a diplomatic disaster.

(17) We had our first SCUD missile alert during the first week of December. There was real excitement that morning. A runner burst into the dining hall at breakfast and announced that four SCUDs had been launched. Everybody took off like a shot to get into chemical protective gear and combat equipment. We half expected terrorist action during a missile attack. It turned out to be a false alarm because Iraq had launched the missiles east-to-west well north of the border as test shots, and we were never a target. We found out later that the missile launch had occurred approximately 40 minutes before we were alerted -- and since it

would take a SCUD only 10 minutes or so to reach Dhahran from Iraq, our faith in the alert system was shaken.

(18) We had another alert later in December, again a false alarm. We didn't get nearly as excited the second time, especially because they told us that it was only one missile. Who would fire only one missile? We had some concentrated anti-aircraft and anti-missile defenses around Dhahran, so one missile would be a wasted effort. I decided that when they launched 20 missiles I would worry. We all became armchair military strategists and spent lots of time analyzing the situation and making our predictions.

(19) In late December the authorities started allowing the troops to go shopping downtown in small groups. I couldn't believe it when they did it, because they were continually telling us that the terrorist threat was high. Naturally, our young troops bopped down to the shopping district like they were going to the mall back home, and probably confirmed the Saudis' worst thoughts about us. I did my looking around early, because I didn't expect the privilege to last. A run-in with the police or the religious police (the Society for the Prevention of Vice and the Propagation of Virtue) seemed inevitable.

(20) In November and December I was working some nagging wastewater and infectious waste disposal issues with the CSH and Evacuation Hospital (EVAC) staffs and the XVIII Corps Environmental Science Office, MAJ Wren Walters. My percolation tests warned me that wastewater disposal was going to be a problem because water, and especially "greywater" (washwater), simply did not soak into the desiccated subsoil and hardpan underlying most hospital sites we were using. A CSH in full operation was expected to generate 20,000 gallons of greywater daily, and EVACs even more. That is a lot of water to dispose of if it won't soak into the ground. The ARCENT engineers had some ideas about contracting construction projects to install subsurface tanks and hire contractors to haul the water away, but we in the field considered anything involving contractors or construction more complex than digging pits to be impractical. The tactical plan had our CSH and EVAC hospitals placed far forward in anticipation of rapid advances during a ground offensive, and elements of the CSHs were expected to move

essentially like a MASH, so we needed simple systems that could be quickly set up.

(21) The infectious waste (including body parts) disposal issue was a major concern of the hospital nursing staffs. Why only the nurses seemed concerned was a mystery to me. We tried repeatedly to get a policy statement from ARCENT preventive medicine about how these materials should be disposed of in the field, but were unsuccessful. MAJ Walters eventually drafted a corps policy that specified "burn and bury". How that was to be done was a second problem, because none of the hospitals had anything in which to burn infectious wastes. We recommended barrel or inclined plane incinerators rather than burn pits, but the hospitals had no way of fabricating the devices. A Theater-wide central purchase of locally-fabricated barrel incinerators would have been ideal.

(22) We were also concerned about water supply in Iraq during a ground offensive. Iraq is known to have deliberately poisoned water supplies during the Iran-Iraq War, and there were questions about detection and removal of heavy metals and pesticides that might be used as poisons. I worked with MAJ(P) Scott Haas, the sanitary engineer at ARCENT Logistics, to reassure water planners that the ROWPUs would in fact remove these materials. Booby-trapped wellheads were also considered likely. COL Kenison became involved as well, and developed procedures for opening water wells in hostile territory. This was one of the first projects COL Kenison addressed after his arrival.

(23) By late December I could begin worrying less about Theater-wide preventive medicine issues and more about things like how to get a warm shower in the desert. We had an influx of preventive medicine Reserve units about that time, so our workload dropped off. Elements of the 14th Preventive Medicine Unit (PMU) arrived to support the growing number of VII Corps units, and the 12th PMU arrived in Riyadh to support EAC (ARCENT) units. For a while there we had a large number of preventive medicine people concentrated in only a few assembly areas. The 74th was relieved of the need to support any but XVIII Airborne Corps units, but the 105th (sanitary engineering) and 714th (entomology) detachments were given to the 12th PMU.

(24) The warm shower question was a significant one. Desert nighttime temperatures had dropped into the 30s by Christmas, and we were actually issued longjohns and parka liners. We welcomed them. I thought the Fort Benning people were crazy when they made us take blankets, cold weather gear, and rain gear to Saudi Arabia, but it turned out that we needed all of it. People came up with some ingenious ways of heating shower water in the field, and we took notes during field trips before our unit deployed to the desert. Some units used water heater elements submerged in shower water tanks and powered by electric generators. Other units with field kitchens used the fuel-fired immersion water heaters that come with them. The immersion heaters were the most efficient method I saw.

(25) I got a chance to go to Bahrain to look at a water system the Navy Seabees were installing for the 47th Field Hospital. Bahrain struck me as modern, clean, and a lot more liberal than Saudi Arabia. The only Army unit on Bahrain was the hospital, and the staff lived in villas built especially for them. Not bad. They didn't wear uniforms or carry gas masks or weapons when in town, which we had all grown accustomed to in Saudi. Bahrain was definitely the assignment of choice in the Theater!

(26) We expected the war to start in mid-January. The new moon was due near January 15th, and that's the best (darkest) time for night fighting. We knew a lot would be done at night because we have the world's best night fighting capability. The UN Security Council set January 1st as the deadline for Iraq to get out of Kuwait and we felt we would be fully geared up by then, so mid-January looked likely. We had been told that we would be heading for the desert soon after Christmas, and were looking forward reluctantly to tents, cold showers (if any), and outdoor latrines. We were concerned that Iraq would decide to call the date and start things around Christmas, but of course that didn't happen. I was nervous throughout the holidays because I figured that would be the best time for a preemptive Iraqi strike.

c. Desert Deployment.

(1) As advertised, we deployed to the desert early in the new year. We deployed to a site near King Khalid Military City (KKMC), about 100 miles north of Riyadh and 40 miles south of Hafr al

Batin, on the 10th of January. Hafr al Batin is located in the Wadi al Batin valley that extends north-northeast from north-central Saudi Arabia to form the border between Iraq and Kuwait, and KKMC was built, we were told, to block an Iraqi invasion by that route. It started to rain a couple of days after we arrived, which was a really rude shock. None of us expected that much rain in good old S.A., and our camp was set up accordingly. Our first lesson in campsite selection was "don't set up on the smooth spots, because that's where the silt settles when it rains" (i.e., that's where the lake forms). Several tents flooded, and we slogged around in mud for a few days trying to get our compound in some order. Our number one priority was to build a bunker, and for three days we filled and stacked sandbags. I estimate we filled between 2000 and 2500 sandbags.

(2) The bunker was dug partway into the ground so that only the top portion was exposed. The side walls were built of interlocking sandbags to a height of about 4 feet, capped by a 2 x 6 inch board plate. We placed 2 x 6 inch roof joists on 18 inch centers across the narrow dimension and rested them on the plate, and placed aluminum aircraft cargo pallets on top of the joists. We then placed three layers of sandbags on top of the pallets, and covered the bags with plastic sheeting. Finally, we piled dirt against the sides and across the top of the bunker as both camouflage and additional ballistic protection. We put Astroturf indoor/outdoor carpet on the floor both for comfort and to keep our chemical suits clean, and installed a light and low bench. It was a strong, secure bunker and could hold all of our 22 people.

(3) We had a drill two nights before the air war started in mid-January, during which we dressed out completely in our chemical protective (MOPP) gear and got in the bunker. That was when we found out how snug it was with all the gear on after we had sized it for people in ordinary uniforms. A small but important oversight when you consider that some people have claustrophobic tendencies. You feel like you're in a spacesuit in all that getup, communication is difficult, you can't recognize anyone else unless they speak to you, and it's downright uncomfortable. Compound the feeling of isolation with being jammed into a low ceiling, underground bunker at night with 21 other people, and the jittery ones can panic. It was interesting to observe people. Some became

panicky and decided their gas masks didn't fit properly even though they had been through a gas chamber with them, some became depressed, some were giddy, and some developed short tempers just from being uncomfortable.

d. The Air Offensive Phase.

(1) We were told to pack up and move out on the day the air war started. The Brigade commander decided to move us 150 miles west northwest, so we dropped our tents, loaded up, and were out of camp by noon. After a convoy that took 8.5 hours to go 150 miles, we finally got to our area and wandered around in the dark using blackout drive lights for an hour or so looking for the designated spot. A truck ran into concertina wire and got snagged, and the convoy got broken up. It took quite a while for the sections to recombine. Once we found the site we had to put up a sleep tent, so it was 1:00 in the morning when we finally racked out. We'd been up since 3:00 the previous morning listening to the news, so it made for a long day.

(2) The new area was flat like a pool table and the soil was rocky. We could see for miles in all directions. There was nothing for anyone to hide behind -- you could see a goat from three miles away, and the goat droppings from two miles. The Brigade had picked a nice, smooth, rockless spot to put the tents on, but we pointed out to them Campsite Lesson #1. They got the message and we moved the tents to higher ground. We had to use concrete reinforcing bar for tent stakes, but still bent a lot of them on subsurface rocks trying to get our tents up. Luckily we had engineer support to bulldoze a berm around the compound and doze out some trenches to build our bunkers in. Digging in that ground was nearly impossible, as we found out when we tried to dig shallow holes for soakage pits. The whole area was a foot or less of topsoil over a concrete-like hardpan. The dirt berms were intended as fortifications against the Iraqis, but I was glad to have them as protection against friendly fire in case troops in one of our neighboring compounds got nervous some night and fired off a few M16 rounds in our direction.

(3) We filled another 2500 or so sandbags to build another bunker. We couldn't bring bags from the other bunker with us because they were too heavy to transport in reasonable numbers. We made the new bunker slightly higher, wider, and

longer than the first one so that it would comfortably accommodate 25 people in full MOPP gear.

(4) The carpet wasn't the luxury item one might think. We didn't get tarp flooring for our tents and it wasn't available in Saudi, so we bought the carpet as a substitute. It was a great investment just for the morale benefit of having grass-green soft flooring in the tents. We didn't have a light set, either, so we bought fluorescent light fixtures, wire, and plugs and wired up our own. Another good investment, because the lighting was terrific. Kerosene heaters were another item that had to be purchased because the military heaters were unavailable. We bought Toyostove heaters that worked great and didn't have any smell at all. All in all, we were fairly well set.

(5) Our new area was the corps logistical base named Log Base Charlie. We were located approximately 30 miles east of the Rafha on the Trans-Arabian Pipeline (Tapline) road, just at the dividing line between the French/82nd Airborne and 101st Airborne Division areas. The French Sixth Division formed the corps west flank at Rafha, with the 101st east of them and the 24th Infantry Division (Mechanized) taking up the east flank adjacent to the VII Corps. The 3rd Armored Cavalry formed the covering force out in front of the divisions, and the 82nd Airborne Division was in the reserve behind the French. The 1st Cavalry Division was in the rear as well, and had been designated as the Theater reserve division.

(6) Log Base Charlie was about five miles from the old Saudi-Iraqi border, but more like 20 miles from the new "de facto" border drawn after the Kuwait invasion. There were lots of gunfighters around, especially attack helicopters, and we had a Patriot air defense missile battery covering us, so we felt fairly secure. The major threat to us was FROG rockets (Free Rockets Over Ground, similar to the Multiple Launch Rocket System), SCUD missiles (which the Patriots hopefully would take care of), and Special Operations types (sappers) sent in to disrupt rear area operations. A military police (MP) battalion provided backup rear area security and we were surrounded by friendly units, so we didn't worry excessively about sappers. There were logistics targets around us including a large water treatment and storage site 1.5 miles to the west, a 3.6 million gallon tactical petroleum terminal 1 mile east, an

ammunition supply point a mile or so to the north, and a communications center to the south.

(7) My main job at Log Base Charlie was to help coordinate the activities of our LB teams regarding the water mission. Our units in the desert were assigned by us to support Corps Support Groups (CSGs), which in turn supported the divisions. The CSGs belonged to the 1st CSG of XVIII Airborne Corps. Our teams worked with the CSG's Quartermaster water supply assets to bacteriologically test and certify 50,000 gallon fabric storage tanks and to make sure bulk water storage and distribution points maintained adequate chlorine residuals. It was a continual battle, especially in trying to get the water storage units to properly superchlorinate the fabric tanks before trying to use them. Bacteriologic contamination due to incorrect superchlorination was a nagging problem that delayed the opening of water points at several times and locations during the conflict.

(8) In the weeks before the ground offensive started we heard and saw lots of aircraft, including jets and tankers heading for Iraq. We occasionally heard bombing at night. One night we heard bombing and the next day were told that the Air Force had taken out a mobile SCUD launcher north of us. We heard some artillery occasionally as well, but it was just routine preparation, or "clearing the throat" as the boomers put it. There were two Iraqi divisions north of us at one time, and there were occasional reconnaissance-in-force missions by Iraqi armor units along the border about 30 miles west, but no major conflicts developed.

(9) As units made rapid redeployments to the west in preparation for the eventual flanking drive, transportation assets became more and more difficult to get. Mail began piling up in Dhahran because all the transport was tied up with beans, bullets, and fuel. Units found excuses to send one of their vehicles the 500 miles back to Dhahran "on business" so they could pick up mail. The 1000 mile roundtrip was felt to be worth the effort, because mail was a major morale factor. It was a dangerous practice, though, because we were losing a lot of soldiers to wrecks caused by unskilled and reckless Saudi and expatriate drivers. A four lane highway in S.A. was any road with paved shoulders. I actually saw, more than once, two vehicles passing a third, with all three abreast! The Tapline road parallels the Trans-Arabian pipeline

and is only east-west highway running along the Iraqi border, and it has two lanes. I saw the results of at least 20 head-on collisions along that road. The traffic volume was intense during the westward movement, with convoys running day and night, and people got tired, impatient, and careless. For the expatriates and Saudis I would also add "stupid". It was a shame to lose a soldier in a traffic accident over here, and we lost a lot of them.

(10) We also lost two soldiers to a bunker cave-in and one to a rotating pump shaft. The collapsed bunker was a small one for perimeter guards and collapsed under the weight of the sandbag roof. We looked over a large bunker in progress at our Brigade headquarters and stopped the builders from making some potentially fatal design errors. Three layers of sandbags on a large bunker can weight between 30,000 and 40,000 pounds dry and much more if allowed to get wet, so a bunker's supporting structure has to be strong. The roof supports we saw were very poorly designed and placed, and the bunker could have collapsed during an artillery bombardment.

(11) The pump shaft accident hit pretty close to home with the Quartermaster water units. Saudi water wells often had submerged turbine pumps driven by rigid vertical shafts coupled to a horizontal drive shaft and diesel engine on the surface. A ROWPU operator wearing a loose parka got near an unguarded shaft and was snagged into it. He was bounced off the steel beam frame at 1700 rpm and pretty well torn to pieces. Another needless death. All the wells had shaft guards after that.

(12) We also lost soldiers to accidental gunshot wounds. We lost a Lieutenant at the 86th Evacuation Hospital in February when he decided to demonstrate the safety features on a 9 mm Baretta by placing the barrel to his forehead and pulling the trigger. That turned out to be a fatally stupid thing to do. Several people suffered M16 wounds to the leg from their own weapons, some of which were no doubt intentional. All I can say is, it's a good thing we didn't issue hand grenades.

(13) We lost five people in the CSG alone in one day to vehicle wrecks. It had rained and the roads were slick with the diesel fuel that was poured on dirt roads for dust suppression, and we had three wrecks. In one 5-day period we lost a total of 11 people killed on the pipeline road. By

some measures it was less hazardous to fly a combat mission over Baghdad than it was to drive on the pipeline road. The speed limit was reduced to 45 mph for all tactical vehicles for the remainder of the deployment. Eventually, both civilian and military traffic dropped off as we approached the start of the ground offensive. Military units had moved west, and the locals had moved out.

(14) We had our first real Shemal windstorm in February. Previous storms were mild by comparison. We had been told that the Shemals are often preceded by thunderstorms, and that's what happened. We had thunder, lightning, and rain for an hour just after midnight, followed by high winds throughout the following day. What a mess. You'd think that an hour of rain would pretty well soak the ground, but we still had plenty of dust in the air.

(15) Dust storms were a frequent nuisance throughout February. They lasted for six to eight hours, so in general it was best to just stay indoors until they blew out. Our tents were sandbagged all around and were anchored with the iron tent stakes, but dust still got in. We just got used to it, and did little things to make it less irritating, such as rolling up our sleeping bags every morning and keeping our other bags closed up.

(16) While I was at KKMC on 22 February I saw an A-10 Thunderbolt (Warthog) crash land. I was with 1LT Wade McConnell, commander of the 61st Medical Detachment (LB), and we got lost while looking for one of our hospitals near the airfield. We took a wrong turn and wound up on the flight line, and were asking directions when the plane declared an in-flight emergency on approach to KKMC. He had been shot up by the Iraqis, and had taken some damage. The plane touched down nicely, but then the pilot radioed that he didn't have any brakes. When the plane hit the end of the paved runway and went onto dirt, the front landing gear collapsed. The pilot kept the nose up as he barreled across the dirt, then eased it down after the plane slowed down somewhat. The Warthog skidded around as soon as the nose touched the ground, the main landing gear collapsed, and the aircraft was enveloped in a huge cloud of dust and flying dirt. When it cleared we saw that the pilot was out and running from the plane. His left arm or side looked hurt, but he could still run.

Everybody was happy and relieved that the pilot

pulled off such a tricky landing and walked away from it.

(17) I tried not to spend too much time in KKMC, especially after dark. The skies over KKMC had frequent fireworks displays as Patriot missiles intercepted SCUDs. A friend stationed at KKMC described the fireworks for me, but I had no desire to see them for myself.

(18) In February an Iraqi infantry division moved in north of us along our planned axis of advance for the ground offensive. The Air Force conducted "battlefield preparation" sorties against those positions during the two weeks immediately preceding the ground offensive. Our 18th Aviation Brigade attack helicopters visited them as well. In one week, the division, which numbered approximately 10,000 soldiers, was reduced by about 50%. We could hear and feel the bombing day and night, mostly as dull thuds or just deep vibrations in the ground. The jet and helicopter traffic never seemed to stop. We suffered no artillery or rocket attacks against any of the corps rear positions, which surprised us. Most of us believed that Saddam would try to knock out the logistical support units in the corps rear, so we expected an attack at any time and for sure as soon as the ground offensive started. Knocking out your enemy's fuel and water stores during his offensive makes a lot of sense, so we armchair strategists figured we were in for it as soon as the tanks started rolling. It all made sense, but of course making sense wasn't a prerequisite for anything Saddam did. Anyhow, we were never fired on.

(19) MAJ Jim Wilson, our environmental sciences consultant, and I spent a lot of time coordinating with the corps water production, storage, and distribution units under the Quartermaster water supply battalion, the corps logistical planners, and the ARCENT engineers. We were the de facto liaison between them. The engineers had satellite imagery and other data on potential well sites, the logistical planners would decide where the Log Bases would be, and the water battalion would be setting up on the wells and producing water in those areas. It seemed that we in preventive medicine were the only ones with a complete picture of what was going on, and we had the most complete map overlays showing where the potential water sources were.

e. The Ground Offensive Phase.

(1) Three of us from the 74th went into Iraq during the ground offensive in late February. MAJ Wilson moved out with the Logistical Task Force (LTF) advance element in a convoy that crossed the Line of Departure only four hours after the lead element French troops began rolling across. CPT Armstrong and I left with another LTF convoy that left about 24 hours later. A 91S technician from the 926th Medical Detachment, SSG Noone, went along with MAJ Wilson, and another, SPC Kevin Harris, went with us. We tried to take duplicate sets of equipment in case one of our teams was taken out. MAJ Wilson was to move forward right behind the French elements, and was actually ahead of most of the 82nd Airborne Division elements. He was to help locate water sources in the areas where Log Base Oscar was to be set up near As Salman, 90 miles into Iraq. My team was to do the same thing at Log Base Romeo, approximately 25 miles east of As Salman.

(2) I managed to get an M16 rifle and 240 rounds of ammunition a few days before the offensive started. I didn't get a chance to zero the weapon on a range, but I was happy just to have it. My 9 mm Baretta pistol was more convenient to carry than an M16, but would be small comfort in a firefight! I started to look like Rambo with all the hardware I had to carry -- Kevlar helmet with dust goggles attached; flak vest with ammunition pockets; web gear with ammunition pouches, canteen, first aid packet, compass packet, flashlight, chemical decontamination kit, and pistol; gas mask; and a rifle. All I needed was a bayonet or a big knife to complete the picture. It was a pain in the neck (literally) to carry all that stuff, especially when trying to get in and out of vehicles and to fasten a seatbelt, but I knew that if I ever needed any of the stuff I would be glad it was there.

(3) The French Sixth Division included a regiment of Foreign Legionnaires and was tasked with clearing the Main Supply Route (MSR) we travelled and to take the town of As Salman. The 82nd Airborne Division was behind them and followed on through and then to the east. The plan was to move northeast in a sprint all the way to the Euphrates river, then turn east and block Saddam's units from escaping Kuwait.

(4) It took us 55 hours to drive the 130 miles to the Log Base Romeo site! We would drive for a half hour at 10 mph then stop for two to six hours to wait for who knows what to get straightened out up ahead. The French were supposed to clear our route all the way to the objective, but were behind schedule and had to have the 82nd Airborne folks help out. There really wasn't much resistance, apparently, but there were numerous Iraqi fighting positions along the route that had to be individually checked and cleared. They took over 3000 prisoners on the first day, most of whom surrendered without a lot of resistance. The basic procedure seemed to be that our guys would fire up a position, the Iraqis would take a couple of casualties, then they would surrender.

(5) The trip was largely uneventful for both teams, but MAJ Wilson's group had a couple of surprises their first night. Their convoy was pulled off the road before dawn waiting for whatever, and nearby U.S. artillery batteries unexpectedly opened up with a volley of 105 mm Howitzers and Multiple Launch Rockets. They didn't even know the batteries were there, and it scared the heck out of them because they didn't know if the fire was outgoing or incoming. Their second shock came when a party of 40 to 50 Iraqi soldiers walked right up behind them with their hands in the air and surrendered. They didn't know the Iraqis were there, either! My convoy, as well as MAJ Wilson's, was stuck in a Shemal sandstorm on the second day of the offensive. The storm caused some minor problems for the gunfighters because of limited visibility and generally lousy flying weather, but they weren't held up long. When we finally reached Log Base Romeo we found that MAJ Wilson's team was there instead of at Log Base Oscar.

(6) While in Iraq we were taking Chloroquine malaria prophylaxis tablets (those of us who had them), and also carried nerve agent antidote (2-PAM chloride and atropine) injectors, CANA injectors (Valium, to relax us if we were chemmed), Cipro tablets (antibiotic prophylaxis in case we were exposed to Anthrax), PB tablets (to make us less susceptible to nerve agents).

(7) Every structure along our MSR had been blasted. Cluster bombs and 500 pounders took out buildings down to the foundations. The Iraqi 45th Infantry Division didn't have many

armored vehicles, just trucks, and we saw a lot of blasted hulks along the MSR and in assembly areas near it. TOW missiles fired by tanks, Hellfire missiles and 2.75-inch rockets fired by Apache attack helicopters, and Maverick missiles and 30 mm cannon fired by fixed wing aircraft made a mess of everything on wheels or tracks. Burned Soviet-made T-55 tanks in revetted positions just north of the Saudi-Iraqi border looked like they had been knocked out by heat-seeking missiles to the engine compartments, but they had holes from other penetrators as well. No bodies, though -- we figured the crews had hit the bricks as soon as the shooting started. Those tanks never had a chance and the crews knew it, I'm sure.

(8) Somebody has a big mess to clean up in Iraq. There were unexploded munitions all over the place. We worked at a water well site that had a bunker complex around it and had been visited by the 82nd Airborne. We found three hand grenades (one with the pin still in it) and a mortar round on the site. We notified Explosive Ordnance Disposal (EOD) about them, but they were too booked up to get to them right away. They were busy blowing up ammunition caches all over the desert. Some of the T-55 tanks I saw had caught fire and cooked off their 100 mm main gun rounds, which scattered unexploded warheads and 7.62 mm machine gun rounds all around the vehicles. One of the tanks had not burned -- it was still fully uploaded with ammunition in the auto-loader rack and had a 100 mm round still in the breech. Warheads, rounds, a rocket-propelled grenade, and at least one scatterable mine were dispersed around those blasted tanks. I also saw two unexploded 2.75-inch rockets near trucks blown away at another assembly area. Thank goodness there weren't any minefields in our area (that we came across).

(9) The Iraqi Bedouin will be dealing with unexploded ordnance for quite a while. Seven members of a family were injured in our area when a small boy stepped on a land mine while the family was out scavenging for food. The mine was one of those nasty two-boom time delay jobs that has a small explosion, a 15 second or so delay, then another explosion. The boy's foot was blown off with the first blast, then the rest of the family was hit as they came to his aid. None were killed, fortunately, and they were all treated in one of our CSHs.

(10) The only Iraqi soldiers I saw were enemy prisoners of war (EPWs). They were a sorry looking lot, as I'm sure we would have been in the same circumstances. Our hospitals had few American patients to treat, but were kept very busy with EPWs and civilians. Our Evacuation Hospitals rapidly filled up with Iraqis. CPT Armstrong's wife is a nurse assigned to the 46th CSH at Log Base Romeo, so he visited her there and met some EPWs. Those poor guys were scared to death and weren't even sure where they were. One thought he was in the U.S. Prisoners taken in our area were with the Iraqi 45th Division, one of the straight-leg infantry divisions Saddam put out front as cannon fodder to slow us down. I don't think they were professional soldiers for the most part, just draftees and reservists who didn't want to be there in the first place.

(11) We took an almost unbelievably small number of casualties during the offensive, but we did lose people. Most were due to combat, but some were due to carelessness. We lost an EOD Major along the MSR when a sniper drilled him through the head. He wasn't wearing his Kevlar helmet at the time -- big mistake in a fire zone. Another soldier was lost when he let an EPW get near enough to pull the pin on one of his hand grenades. That shouldn't have happened because (a) the EPW should have been controlled better, and (b) grenades should be strapped to the web gear in a certain way so that the ring can't be pulled. Seven other soldiers died when a Captain picked up an unexploded cluster bomb submunition which then blew up in his face and killed him, his Lieutenant, and five of his soldiers. I don't know what happened along those lines in the VII Corps area, but they probably lost even more people because there were more munitions lying about in Kuwait than in southern Iraq. More mines, especially.

(12) Most of our preventive medicine work in Iraq involved trying to find water wells that would produce water. We had plotted potential well locations on our map overlays before going north, but most of them turned out to be "hand dug and bone dry". The preventive medicine water mission is supposed to be to certify raw water sources before treatment and finished water after treatment, but during the ground offensive we actually did the scouting to locate well sites and helped to get the pumping equipment operating.

We located four drilled wells, but only one of them produced anywhere near enough water to satisfy a 150,000 gallon per day ROWPU's raw water needs. None of the wells had been sabotaged, but the one well we were interested in had nearly been blown up by our own troops during their advance through the area.

(13) It took us about five days to find the well, get the pump working, measure the flowrate, and test the water. The well produced only 100 gallons per minute and the Quartermaster people wanted 350 gallons per minute, but it was all we had. In the end, the Quartermaster folks decided not to even set up their water purification unit, both because the well didn't produce enough water and because there wasn't as much demand as we expected. The troops were moving so fast that they didn't have time to use up a lot of water, and we could truck in all that was needed using 5000 gallon Semitrailer-Mounted Fabric Tanks (SMFTs). Although we spent most of our time on the water problem, our teams also found time to inspect unit campsites and the EPW pens.

(14) By the seventh day things had pretty well finished up war-wise and the temporary cease-fire had been signed, so we decided to pack up and head back. MAJ Wilson and SSG Noone left the day before CPT Armstrong, SPC Harris, and I did -- we decided to stay for another day or two in case something unexpected came up. Our last night wasn't restful, though, because we had a Shemal that night. It rained all the next morning, and we had a mess on our hands trying to get the tent down and folded in the rain and mud. It took us only seven hours to drive back. Not bad compared to the 55 hours it had taken to come in along the same route.

f. Movement Back to Saudi Arabia.

(1) I was glad to get out of Iraq and back to Saudi Arabia. The XVIII Airborne Corps was beginning to pull out after only one week in the country, and our corps-level mission had dried up. We were in Iraq a total of eight days. Everybody immediately began to get excited about going home. I tried not to let myself think about it, because I knew it would take time to process all those people and especially the equipment. It had taken six months of all-out effort to get everything there, and we weren't going to get everything back out overnight. I resigned myself to another four to eight weeks in country at least.

(2) As we prepared to move from Log Base Charlie back to our compound in Dhahran, we were told that we have to empty all the sandbags we spent so much time and effort filling! Apparently the Saudis didn't want their desert littered up with a bunch of holes, dirt berms, and messy sandbags, so we had to do some "installation restoration" on our campsite. Dismantling our bunker, fighting positions, and tent barriers was quite a job. First we had to shovel off the dirt covering, then strip off the sandbags layer by layer and empty them. Then we had to burn the bags. Altogether we had close to 5000 sandbags to empty and burn. Leveling out berms and filling pits meant more work for the Engineers. Those Engineers had done a fantastic job, working 24 hours for most of the time from the time they moved to the desert. They actually scraped a road all the way from Saudi Arabia to the Euphrates river in only 30 hours -- about 200 miles!

(3) It took us several days to empty and burn all the sandbags. We burned the bags and a bunch of lumber and trash in the pit that had been our bunker. It seemed that people all over the compound were burning anything they didn't want to tote back to Dhahran or the States.

(4) Collection points were set up along the Tapline road for "barrier materials", which included concertina wire, sandbags, and wood. The Army let the Bedouin shepherds help themselves to anything they wanted, and everything except the sandbags went pretty fast. The Bedouin liked the barbed wire because it coils up and can be spread out then recoiled for easy transport. The studs and plywood were good for building pens. I guess the Bedouin couldn't figure out a good use for sandbags.

(5) When the 74th deployed back to Dhahran, CPT Armstrong and I volunteered to stay at Log Base Charlie "for a few days" until our corps medical units were all back out of Iraq. A few days turned out to be two weeks. We finally moved back on 23 March. During those two weeks our unit had been getting our equipment cleaned up and packed for shipment. We had to have our equipment inspected by the MP Customs people before shipping, and our vehicles by the Department of Agriculture. There was a lot of concern about pests being carried back to the U.S. in soil. The MPs were more interested in keeping Iraqi weapons from being taken back. A number of

people were arrested for trying to conceal weapons or explosive devices in their shipped equipment.

(6) CPT Armstrong and I took down our tent on 22 March and loaded up the CUCV (Chevy Blazer) for an early start the next day, planning to leave around 0500. We left our cots and sleeping bags out for a night under the stars, but a rain front moved in at midnight and spoiled that. We wound up leaving at 0100 in the morning.

g. The Drive Through Kuwait.

(1) It rained most of the way to the Kuwait border. We drove northeast on the road from Hafr al Batin to Kuwait City, which was paved and in good shape until we hit Kuwait. We were surprised at how green the desert had become during the rainy season. There were customs stations on both sides of the border, about a mile apart, and everything was normal until we got to the Kuwait side. The Kuwait station was shot up pretty bad. Even the mosque was damaged, which surprised me. The farther we drove into Kuwait, the worse the damage was.

(2) The road was a mess because of anti-tank fortifications. Deep anti-tank ditches had been dug across the road and off to each side, but the holes had been filled in again with dirt. Farther in, the road was in much worse shape. The westbound lanes, a separate road parallel to ours, had been plowed up, and our eastbound road craters had been blown about 100 feet apart, alternately on the right and left side of the road. Traffic had to weave between them or run over the filled-in craters, which made for some interesting maneuvering since traffic was moving in both directions on the road. We saw one oil-filled ditch along the road that may have been one of those we had heard about, and in one spot we saw land mines laid out next to the road. There were extensive anti-personnel barricades, consisting of tens of thousands of stakes driven into the ground with barbed wire crosshatched between them so that ground troops couldn't walk through it. The barriers extended in zigzag patterns away from the road in both directions as far as we could see, and were repeated every few miles. Somebody put a lot of effort into those fortifications, but of course none of them could stop aircraft or do much more than slow down tanks and mechanized infantry.

(3) Most of the civilian cars and all of the military vehicles we saw in Kuwait were destroyed. Our cluster bombing was devastatingly effective on

vehicles. Where cluster bomblets had hit vehicles on a road we would see 50 to 100 small pockmark craters 12 inches or so in diameter and a few inches deep in the road, and twisted wrecks of vehicles would be up to 50 feet away from the road. Armored vehicles such as tanks and personnel carriers were burned out hulks, probably done in by Maverick or Hellfire missiles. We didn't stop to look at them because it wasn't safe to get off the pavement.

(4) Just before we got to Kuwait City we drove through another good-sized suburb that borders it. Buildings along the road had been taken over and fortified, usually by filling in the windows with cement block except for a firing port. We saw children waving at us from alongside the road, so we stopped to say hello. They didn't speak English, of course, and neither of us could say much in Arabic, but they knew enough to ask for chocolate. We didn't have any, and as we were driving off one of the older ones looked surprised and a little alarmed as he pointed to his mouth and cried "food!". We realized then that the children were hoping to get food from Americans driving through. We were still figuring it out about a block later when approximately 15 kids rushed out into the street from both directions and I had to slow down to avoid running over some. There were too many of them for us to stop, so we drove on another couple of blocks and stopped to move cartons of rations from the back compartment to the front seat. We felt awful about not anticipating what the first group of children needed, and were determined to have food available for the next bunch. As we got into Kuwait City, though, there were fewer people and hardly any kids on the street at all. Maybe the fact that it is the month of Ramadan had something to do with that. Ramadan is the month of daytime fasting in honor of the Koran, and Muslims can't eat or drink anything during the day. They usually stay up all night and sleep all day during Ramadan, so you don't see many adults around in daytime. We stopped twice to hand out food, but the kids didn't look malnourished at all. I think we may have been passing through a non-Kuwaiti neighborhood in the suburb, maybe even Palestinian, where food wasn't readily available.

(5) In Kuwait City the destruction was unbelievable. Essentially every building was burned, blown up, or empty. We saw almost no

pedestrians and very little vehicle traffic. Paramilitary checkpoints were set up all over the place to check drivers' papers, but they just waved us through, usually with a friendly smile and a wave. In the downtown area most of the hotels were burned and stores were burned and/or looted.

(6) We eventually made our way to the main street along the beach. The beach had been heavily fortified against an expected amphibious landing that never occurred. Broad German-style brick sidewalks along the road had been torn up so that the bricks could be used to build trenches, pillboxes, and bunkers along the beach. Anti-landingcraft obstacles were placed in the water, and concertina wire was strung along the beach. The fortifications extended the whole length of beach that we could see, which was a long way. The royal palace was destroyed, we heard, but the area was restricted and we couldn't get in to see it. Utilities in Kuwait City were still messed up when we were there. We saw a huge pile of trash on one corner, and saw people with buckets on ropes pulling water from an underground tank of some kind. It was no wonder they were having outbreaks of waterborne diseases such as cholera and typhoid.

(7) We left Kuwait City and headed south along the main road toward Dammam/Dhahran. We saw more destroyed Iraqi vehicles along the way, mostly along the northbound side of the road. The Kuwaitis had already hauled many of them off, and were loading a T-55 tank onto a Heavy Equipment Transport (HET) as we drove by. Just south of the city we saw the smoke cloud from the burning oilwells in the Al Wafra oilfield. When we saw a turnoff for Al Wafra we decided to try to get closer to the field and take some pictures, but couldn't manage it. The road lead to the town of Al Wafra rather than the nearby oilfield, and we couldn't get closer than about 10 miles south of the field. Even from that distance we could hear the roar of the fires and could count 17 large fires through the smoke.

(8) The Al Wafra turnoff wasn't a complete loss, because dug in along the road was a division-sized Iraqi bunker complex. We saw a four-barrelled 20 mm antiaircraft gun and stopped to take a look, then noticed all the other bunkers. We looked around and came across a number of helmets, gas masks, berets, and other uniform pieces. Those Iraqis were dug in to stay, complete

with goat and chicken pens. Some of the bunkers were amazing -- I saw underground bunkers with concrete floors, wood paneling, screen doors, fluorescent lights, and even one with its own latrine! When we finally headed on south we came to the port town of Kafji, famous for the only serious Iraqi incursion into Saudi Arabia. It was shot up some, but the damage was nothing compared to Kuwait City.

(9) The trip was a long one, about 17 hours, but it was worth the drive just to get a better appreciation for why we were there. The damage to Kuwait was incredible, and almost all of it was deliberately done by the Iraqis. A couple of days after we got back, CPT Armstrong and I drove over to Bahrain with 1LT McConnell of the 61st Medical Detachment and by coincidence we ran into four Kuwaitis who had just come down from Kuwait City after having been holed up there during the occupation. One was a fireman and another a policeman. They had experienced the Iraqi occupation and were sincere in their appreciation for their country's rescue.

h. Back to the Desert.

(1) CPT Armstrong and I were in Dhahran all of four days when we got a call to come back out to KKMC to do radiological surveys of damaged U.S. armored vehicles. We use depleted uranium instead of lead in some of our anti-armor munitions (it's heavier than lead and will penetrate thicker armor), and some of the vehicles were contaminated with low-level radioactive material when they either burned up while carrying DU munitions or were shot by DU munitions as victims of "friendly fire". CPT Armstrong was asked to help two AMC civilian employees who were sent over to handle the problem, and I went with him because I have some training in health physics and because CPT Armstrong was my partner. A 1LT from the 12th Preventive Medicine Unit in Riyadh also came to KKMC to help.

(2) We surveyed a bunch of burned up, blown up, and shot up vehicles to find the contaminated ones. We were in the process of doing detailed measurements and figuring out how to pack the vehicles up for shipment back to the U.S. when we were called by the 74th and told to get back to Dammam immediately. Our guys had to have the CUCV so they could steam clean it and turn it in for pre-shipment storage. We didn't get the call until the afternoon of 31 March, and had to

have the CUCV in Dammam by 0600 the next morning. We packed up and left that evening, and drove back to Dhahran.

i. Redeployment.

(1) In early April we turned in all of our equipment and vehicles for storage. We came down on levy for 17 April and were told to move into Khobar Towers, a cluster of approximately 150 highrise apartment buildings that had been built in the 1980s as Bedouin housing, but which had never been used. ARCENT was using the Khobar Towers as its redeployment center, and routinely moved units in for a few days prior to their departure just to keep track of them and to make sure they were ready to go when the plane was.

(2) We flew out early in the morning on 17 April, arriving at Fort Benning's Lawson Army Airfield at 0300 on the 18th. The Infantry School commander, a major general, was on hand at that early hour, along with a brass band and all the family members. It was quite a welcome. We turned in our weapons and gas masks, then retrieved our duffle bags and rucksacks, which was no easy task because it was dark and all the bags looked the same. I signed out of the unit and was on a commercial flight to Baltimore by 0700 that same morning.

(3) We had travelled back on a charter Pan Am 747 through Rome, New York, and Savannah, Georgia, to Fort Benning. In flying commercial from Columbus, Georgia to Baltimore I passed through Atlanta, still in my DCUs with my Kevlar helmet tucked under my arm. It was obvious to travelers in the Columbus, Atlanta, and BWI airports that I was on my way back from the Gulf and I was pleasantly surprised at the number of people who spoke to me on the planes and in the airports to express their appreciation and congratulations. The welcome was overwhelming and gratifying, and made the whole experience something special. In my case, it was the best possible way to finish up my 20 years of military service.

Editor's Note: Major Johnson was discharged from the Army on 31 October 1991. We are appreciative of his contribution to this history.

2-29. NURSING.

By: Captain M. Debra Parker
Occupational and Environmental Medicine Division

a. August 2, 1990. Iraq invaded Kuwait. Much furor throughout the world. I don't know what this yet means in terms of military support. I guess there's a good chance that I could be flying to Germany if we go to their assistance.

b. August 10, 1990. I called the squadron but they haven't heard anything except rumors yet. However, the 72nd from McGuire and some guard TAC air evacuation units have deployed to Saudi Arabia. I decided to begin to assemble needed items just in case.

c. August 24, 1990. I went to the squadron from the Agency today because it is drill weekend and I needed to get some work done before Saturday morning. The squadron has a lot of personnel around for a Friday night. People are very nervous about the threat of war and what that means. I answered the telephone and it was HQ MAC calling LTC Bomar. This must be it! LTC Bomar was still on the telephone when I finished and went to my room for the night.

d. August 25, 1990. I don't really have anything to do this weekend because all flights have been canceled. LTC Bomar announced that a tasking was received and 24 people will go somewhere on Tuesday morning. My name was called. I'm proud, excited, scared, and numb all at the same time. I drove home this evening rather than stay at Andrews. Mark was ill with the flu and asked me why I was home. I just looked at him, said guess and started crying. We hugged and just sat for a while. Then I went into action and began packing for an unknown destination and believing that I would be home in about 90 days.

e. August 26, 1990. I drove to Andrews for the remainder of drill weekend. There was much buzzing about. Several of us went to church then lunch. LTC Bomar told us we were going to Saudi Arabia. We were dismissed at 1300 and told to return in the 0700 for the mobility processing line. I had to go home and repack. It never crossed my mind that I would go to Saudi Arabia - the war zone - as a STRAT EVAC nurse. I'm stunned. I thought only TAC EVAC went to the front. In

reality our mission was to fly missions from SA to Germany after the TAC crew brought the patients to a more rear area in SA. I called my parents and Mark's parents. More tears were shed.

f. August 27, 1990. The day started early and we were busy until midnight. We had to do weapons qualification, obtain our chemical warfare equipment, attend predeployment briefings, go through the processing line, and pray that our aircrew chemical warfare ensembles come in from Kessler AFB before the morning. Billeting arrangements were made for everyone to stay at Andrews but I declined. I wanted to go home and see Mark and my daughter, Shawna, before I left even though it was 0100 and I had to be back at 0800. I was exhausted and continued to intermittently cry. It's a good thing I wasn't stopped for speeding because they probably would have thought that I was on drugs.

g. August 28, 1990. Mark drove me to Andrews. We had a very teary breakfast at Burger King then he dropped me off at the squadron. We loaded the bus and left for Dover at 1000. One of the colonels from the wing gave us a farewell song titled "Here's to the Regular Air Force". It was sung to the tune of My Bonnie Lies Over the Ocean. It was cute but a slam to the active duty side of the house. At Dover, we were instructed to stay in a processing hangar until our 1800 flight aboard a beautiful C5 to Rhein Main. The hangar wasn't bad. It had cots, a snack area and a unisex toilet that was less than desirable. We're off.

h. August 29, 1990.

(1) We landed at Rhein Main about 1000. We were told that a C5 had crashed in Ramstein a few hours earlier. We were given about 3 hours to eat and shower before continuing our journey to Dhahran, SA. By this time most of us were functioning on a single brain cell, catnaps, and caffeine but we were too anxious to sleep. We arrived in Dhahran at 2030. It was hot and windy. It really felt like an oven. A C130 was supposed to take us to Riyadh but it never arrived. We were all sitting around the MAC ALCE on the flight line all night. Every 20 minutes two British Tornados would take off to fly sorties along the border. The night was filled with 747's, C5s, KC135s, C130s, and numerous other aircraft discharging hundreds of troops and supplies. There wasn't an empty parking area on the ramp. When one aircraft left another would take its place. I remember thinking

we're really going to have a war. This isn't a dream. When the sun came up it was apparent that we were in a desert. It was sandy, windy, and extremely drab. There was no color except for a dusty looking sunrise.

(2) We finally secured space on a C5 to Riyadh at 0830, August 30, 1990. Only after much groveling. We arrived in Riyadh about an hour later. It was about 120 °F. Men were allowed to remove their BDU tops but women weren't. What kind of country is this? Why would anyone want to live here? We broke down the pallets and loaded a bus. The bus took us to the Intercontinental Hotel. It was beautiful, had grass, palm trees, and air conditioning. We definitely looked and felt out of place in that lobby but the employees were very friendly. I was in awe of the wealth around me.

(3) Later in the evening we had a commanders call. Several briefings on culture, aircraft configuration, chemical warfare, and schedules. I remembered about a tenth of what I heard. Fortunately, each of us remembered different things so we were able to piece together the evening. This place is strange. Women don't drive, they don't talk to men or look them in the eye, and they must wear a black robe called an abaya over a long dress or loose pants and a long sleeve shirt. We aren't supposed to look enticing to the opposite sex. Ha Ha. How could anyone look enticing in this heat? The local women must also cover their hair and faces but we were told that it isn't necessary for us to cover our faces. However, we were encouraged to cover our hair if it is red or blonde. The men dress in long white robes, thobe, with a white or colored headdress, guhtra. The women look like they're going to a funeral and the men look like they're ready for bed. Men are affectionate toward each other and they hold hands. Women don't hold hands with each other or with men. Women usually stay a few paces in front of or behind the male relative they're with. We were told not to go out except in groups and to always have a male with us. We were also told not to go out in a group if the number of men exceeded the women. The hotel had a beautiful swimming pool but it was for males. The hotel manager and his wife opened their pool to the American women during our two and one half week stay there. It was a generous gesture on their part.

(4) Well, we had two very nice weeks getting used to the culture and the climate before our move to ESKAN village. Little did 1LT Jill VonRothe, friend and co-worker, and I realize at that time it would be home for the next 7 months. We moved on September 15, 1990 to this uninhabited place 20 miles or so outside the city. It was a small town that reminded me of a ghost town with nice buildings. There were relatively few automobiles around so we walked a lot. We had plumbing and electricity. We also had a hugh sunroof to hang laundry, sit in the sun, and watch shooting stars. The sky was so clear at night and the weather so warm that one could often fall asleep literally under the stars. What more could you ask for if you had to go to war. Others weren't so fortunate because they had to be on the front lines and be very mobile. My heart went out to them. We kept busy doing a variety of things. Jill started working in medical supply and eventually inherited the title of OIC of Medical Logistics. She did a great job and I was proud to have her as a friend/roommate. I took on the task of ensuring all new medical crew arrivals were prepared for chemical warfare. This meant checking masks for fit, checking aircrew masks and filter packs and offering inservices on chemical warfare preparation.

(5) In our spare time or when we were on alert we would play cards, read, talk, or exercise. We managed to find a way to get to the shopping area in Riyadh many times. Jill and I spent hours in the gold and rug suks. Eventually we spent lots of money also. Our most clandestine adventure occurred in March when we dressed like a Saudi couple and drove downtown. We parked in a back alley so I could remove the male disguise and once again become a female. We used this several times to get around.

(6) Gradually at first, then rapidly in December ESKAN became little America for thousands of us. MWR acquired books, videos, exercise equipment, and offered sightseeing trips around the area. Our single chow hall (temper tent) multiplied to five separate chow halls to accommodate all of the U.S. troops at ESKAN. I went to work in the AECC in October. I was so happy to be working. It helped the time pass much faster. One of the oddest sights is to go past the entrance to the mosque inside the Royal Saudi Air Force HQ Building during prayer time. The Saudis

are all praying and all their combat boots are sitting outside. I often wondered how they could find their boots after prayer. I also wondered if they would continue to have their five prayers a day when the war started. I could just picture everyone laying down their weapons, removing their boots, and kneeling toward Mecca for 20 minutes. Hello Saddam, hold the war.

(7) As the fall season approached we implemented training missions on the C130 to give C141 crew members exposure to the C130 and afford those not flying many missions an opportunity to fly. We continued to try and get out around the Riyadh area on our days off. This was difficult because we had to find a male driver and a vehicle. We did manage to see the desert diamond fields, Diriyah, Acadia forest, the camel suks and trail, and the red sands. These were all excursions on various days off. The local western community in the Riyadh area held desert concerts monthly from March until November. These were held in a remote desert canyon far removed from the Saudi community because it was mixed company and families. A taped classical program was broadcast over a portable speaker system in an acoustically correct canyon under the stars. It would have been romantic if we had shared the experience with our significant other. Under the circumstances it was a very relaxing experience and mentally took us far from the situation that we were actually in. October was now here. It was hard to believe we were still here and no fighting yet.

(8) Eshan village was planning a Halloween party complete with cook out and games. The feature attraction was a camel ride. The temperament of the chosen camel did not allow more than a seated photo session. She was not happy about being there and growled at everyone who came close. October also brought a shiggella type illness acquired from the chow hall. A lot of Lomotil, phenergan, and IV fluids were used over a two-week period. Although the active duty did become more involved in the messing activities following the outbreak, I chose to eat MREs and box lunches after that. We were sure biological warfare had been instituted.

(9) We had to abide by the local customs therefore the females were not allowed to drive. It soon became evident that this imposed a hardship because it took at least two people away from the duty section every time a female had to go

somewhere. The situation was negotiated. The results were that females could drive military vehicles on the base/post but not beyond the gates. This solution helped very little. Soon females were driving military vehicles from installation to installation in uniform with hats on. No one was quite sure if it was policy or just evolved but we were not challenged.

(10) When November rolled in we were beginning to see an increase in troop strength. Intratheater channel missions were negotiated and implemented. We placed TAC crews at southern locations where the C130s were based. They flew designated routes and dropped the patients off where definitive care or further AIREVAC could be accomplished. We in the AECC were also beginning to see our overall workload increase. Many long days and an increase in tension was apparent. JMRO proposed we consider contingency regulating. This meant that we would not take a patient report but would move patients by disease category code. It decreased our telephone time but increased the frustration level because frequently patients supposed to move didn't, unregulated patients moved, and flight nurses were subjected to many surprises during a mission. For example, we might tell the crew to expect 10 patients at a given location and 25 would show. Without names and diagnosis we couldn't assure accurate patient counts. In any event we persisted with the contingency method in spite of the pseudo-peacetime role we were in.

(11) Thanksgiving was different. The chow hall had a traditional meal with paper decorations and designer plastic ware. Let's not kid ourselves we weren't with our families and it was lonesome. Our 90 days are almost over and still no fighting. There's the constant reminder of terrorism but even that hasn't surfaced. All in all people stay just a little edgy. LTC Brannon, CO, asked Jill and me to consider staying since we were in key positions. How could we say no? We had already heard the squadron was going to get another tasking but to where no one knew. We agreed rather than go home and be sent to another location. Special orders were cut for us with MAC approval. We're committed. What have we done? It's great to be recognized for performance but did it have to be in a war zone? Guess I'll have to show USAEHA that I really do have excellent management skills. Who knows, maybe they'll hire me. The support

from the U.S.A. was tremendous. Letters and packages arriving all the time. I wrote to many kids. They sent Kool Aid, drawings, posters, and seasonal decorations. Many of the adult letters included poetry. One of them I became attached to and is shown on page 2-44. Bob Hope held his show at Eskan. He really is a terrific person. A lady by the name of Emma Smith made a Christmas tape of one song 'An American Christmas Greeting' just to remind us that we weren't forgotten. I almost wore the tape out but it helped to get through the holiday season. USAEHA sent a huge box of gifts. Jill and I had a blast opening them. I used my water pistol frequently. We also found some Christmas tree lights that were 220V so we made a tree in our window.

(12) The scud alerts are becoming more frequent. The MPs drive around Eskan broadcasting the alarm level and MOPP level. Invariably this is around 0200 and I have to get up at 0400. We're now working 6 days a week about 12 hours a day. We smoked a turkey on a 55-gallon drum grill made for us by CE. Our New Year's celebration was Pictionary and Near Beer. More AIREVAC crews arrived the same day. I really miss Mark and Shawna. This is the first Christmas we've been separated. Mark writes frequently and tells me what is happening on the home front. He said Shawna started a yellow ribbon campaign at the High School and was on Channel 2 news. He also said she's playing Lacrosse and Field Hockey. She's on the honor roll too. I guess my being away isn't so bad. Sometimes I can get through on a morale call and talk to them. I've been successful in getting a line to OEMD several times. One time I tried to call home and the operator would not connect me so I called the SDNCO at USAEHA and she called my house with an I love you guys message. I don't know who that was but she was a Santa Claus for me. Intel reports are more ominous now.

(13) The weather is cooler but not cold. It rained on January 5 1991 in Riyadh. That was the first time I had seen rain since I left in August. We're working 7 days a week 16 hours a day. We have special OPS missions to support as well as our regular channel missions. LTC Brannon is very tense. He wants all the windows boarded and cots available for those in the AECC. He's unsure how much longer we'll be allowed or have the time to drive the 25 min to Eskan. I'm so tired. I just

want to sleep one night with no air raid sirens and not have to get up at 0400. When will this happen?

(14) A new mission is surfacing. The Saudis have an AIREVAC system supported by western contract nurses. Most of these nurses left so they have no one to fly as medical crew. LTC Brannon told them we would support them with crew as long as we could. It was truly a unique experience to fly on a Saudi C130. The inside was elaborate and contained more sophisticated equipment than our C9. 0400, 17 Jan 1991 telephone rings. One of our admin techs said his wife just called and the war has started. I was stunned and turned on CNN. Yes, we had a TV and a telephone in the villas by then. I dressed for work because I was driving. Yes, even that had changed by now. We females had started driving the rental vehicles in uniform with our hats on of course. It was a slow day at the AECC. The KC135s were constantly taking off in groups of 3 or more. That was our unscientific way of determining how heavy we were striking. Our AIREVAC mission did not change significantly even though the war had started. We just didn't have the anticipated U.S. casualties thank God. Work continued and so did the Scuds.

(15) A patriot brought down a scud about one half mile from where we worked on USMTM. Fortunately for the residents of Eskan the nearest Scud landed about 3 miles away. I came to appreciate the words from our national anthem 'bombs bursting in air'. The air war is going well for our side, now the ground forces must consider their moves. Intel brief showed us the flanking proposed maneuver, now we need to move our MASFs forward. We requested ground and air support to accomplish this move. BG Tenoso supported AIREVAC and we had people on the road in 24 hours. Thankfully none of them encountered the casualties anticipated with the ground war. Some did stay steadily busy though.

(16) Unfortunately we have POWs. No one is certain of the actual status of these people but we're all hopeful. We have begun to plan the POW mission that we anticipate will come. The POW mission actually became three separate movements. The grand finale of course was their flight to Andrews AFB on March 9, 1991. It was also my birthday. I was celebrating four decades flying with a former POW patient to my home. I saw Mark and Shawna and we quickly celebrated at

a local establishment, Burger King. Then I was off to Riyadh with promises of returning soon with Jill. Its Ramadan season. It is the holy season for the moslems. They are not allowed to eat, drink, or have sex from sunrise to sunset. This means that they get cranky in the afternoon from dehydration and lack of food intake. The westerners are not allowed to eat or drink in public during this month. One can be put in jail if caught doing so. This also means that stores are open from 2030 hours until 0300 hours. I've never shopped in the middle of the night before. It feels strange.

(17) The 2nd AES from Rhein Main arrived in Riyadh to take over the AE operation so that all of us could go home. We transitioned over the next two weeks and were getting ready to leave when quite by accident we found out about the AFRC in Bahrain. It was a cruise ship being used for R&R purposes. We decided that it would be a nice transition period before returning home. We were allowed two days and three nights on board. Everything but beverages was included. It was a wonderful time to be a female because the men outnumbered the women 8 to 1. We didn't have to buy a drink. All we had to do was dance, talk, and eat with the guys. I would have been in heaven if I had been a teenager, single and a female. Under the circumstances I was flattered. We returned to Eskan on April 4th.

(18) There was a special tribute to DS/DS on TV. It was at Andrews. We saw some of our squadron peers. I was so excited when I saw them plus I had discovered a C141 leaving Riyadh going to Andrews on 6 April 1991. Jill and I packed our magic carpets and went to the ACLE to talk to the pilots. We told them we wanted to thumb a ride to Andrews. They said YES! We're going home. We were dancing around like fools because we were so excited.

(19) We arrived 12 hours later than scheduled at Andrews but the squadron CO, wing CO and several civilians were there to greet us with a nice reception. We were exhausted but ecstatic. Mark and Shawna were there with a single red but wilted rose. It felt so good to be home. Friday of the same week Mark took me to the USAEHA spring formal. Col Bishop, whom I had never met, greeted me warmly as if he had known me for ages. It was indeed a pleasant surprise. He also gave me one of the patriotic centerpieces at the close of the evening. It really will be nice to get

back to work. Mark had made a camel and adorned it with flags of the nations participating in the gulf war. It was very creative and a gift I will cherish forever.

(20) Jill and I had to remain on active duty until June to support the crews we had in Germany. I attended the USAEHA picnic where a special celebration had been planned for all those from the USAEHA who had participated in the war. We received a plaque which included a photo of my camel. The plaque features a picture of a carved wooden camel. The camel has the flags of all the nations of the consortium. The plaque bears the USAEHA crest and an engraved plate which reads: "In appreciation for your efforts on behalf of USAEHA in support of Operation Desert Storm."



The Plaque

My Favorite Poem

I've heard it said the world's a dismal place.
But I know better....

for I have seen the dawn, and walked in the
splendor of the morning's sun--blinked at the
brilliance of an autumn landscape.

I've heard it said the world is sad.
I can't agree...

for I have heard the cheerful songs
of feathered masters...heard the low laughter
of the leaves, and the everlasting chuckle
of a mountain brook.

I've heard it said the world is a musty sordid thing.
It can't be true...

for I have seen the rain...watched it bathe
the Earth, the very air...and I have seen the sky,
newly scrubbed and spotless, blue from end to end...
and I've watched the winter's snow drape tree and break
to look like nature's freshly laundered linen hung.

I've even heard it said the world is evil.
But they are wrong...

for I've known its people...watched them die
to save a freedom, bleed to save a life--spend of themselves
to stem disaster, of their wealth to ease distress...and
I have watched them live, love and labor...watched them
hope, dream, and pray, side by side.

I have heard them say these things
But I would disagree...
because, for every shadow, I have seen a hundred rays
of light...for every plaintive note, I've heard a
symphony of joy...for every penny weight of bad I have
found a ton of good...good in nature, in people, in
the world.

And I'm thankful I belong.

*Bernard Patrick
(John Deere)*



Nurses Only

2-30. VISION.

By: LTC L.D. Solverson
Occupational and Environmental Medicine Division

a. The Army sent four contact lens teams consisting of one optometrist and one 91Y eye specialist into the KTO with the mission to fit selected aviators with contact lenses. I was in team No. 3. Aviators from the XVIII Airborne Corps and VII Corps were fit and all accounts indicate the mission was tremendously successful. In addition, the teams provided the following badly needed area optometric support at echelons above division by attaching to deployed hospital units:

Pre-fit screenings	220
Fittings	132
Follow-up exams	275
Routine exams	1,144
Trauma exams	32
Optical devices ordered	<u>1,050</u>
TOTAL	1,853

b. The following comments and/or recommendations were made:

(1) Contact lenses were a tremendous improvement over spectacles when using night vision goggles (NVGs), telescopic units (TSUs), and heads up display units (HDUs).

(2) Aviators with contact lenses reported enhanced vision with contact lenses. Spectacles were susceptible to scratching and being constantly covered in dust. Contact lens wearing schedules were reduced to provide a safety margin during harsh desert conditions.

(3) Both commanders and flight surgeons must have a better understanding of aviator's vision and eye health requirements while wearing contact lenses. Education is essential.

(4) More complete prior coordination, greater command emphasis and adequate ground transportation would have reduced delays and resulted in a wider dissemination of services.

(5) Reconfigure the field optometry set for size and weight to increase mobility and capabilities.

CHAPTER 3

POST WAR

Section I. PREVENTIVE MEDICINE

3-1. Ms. Ilani A. Donley, Plans, Training, Mobilization and Security Division, and CPT Rodger J. Rudolph, Waste Disposal Engineering Division, were tasked to inquire into a special task force going to Arabia. They conducted negotiations including site, cost, dates, and topics, and how to prepare and administer contracts. **Impact:** Short response time negotiated to prepare officers for assignment and provide a source for translation support.

Section II. INDUSTRIAL HYGIENE

3-2. Ms. Toni A. Bishop, Radiological and Inorganic Chemistry Division, performed industrial hygiene air sample analysis for Fort Knox,

Kentucky, 12-19 February 1991. The operation involved heating zinc wire so it can be sprayed on wooden targets (gun computer boards). **Impact:** Proper industrial hygiene recommendations were made.

3-3. Major Charles E. Goodman, Jr, Environmental Health Engineering Division, USAEHA-South, conducted a consultation at Pine Bluff Arsenal, Pine Bluff, Arkansas, 18 February - 1 March 1991. The industrial hygiene technician was called to active duty resulting in personnel shortfall. Major Goodman provided personnel monitoring on phosphoric acid and white phosphorous lines. These lines were activated for ODS. **Impact:** Allowed safe and healthful operation of these lines that were producing ordnance for direct support of ODS.

Section III. NONIONIZING RADIATION PROTECTION

3-4. Mr. William Siller, Laser Microwave Division, assisted the USA Test and Evaluation Command, APG, February-April 1991, by evaluating three ground penetrating radar systems required for safety releases. Impact: The exact use of these systems is classified; however, they were required to support ground operations during ODS.

Section IV. WATER

3-5. Mr. Michael Lanahan, Radiological and Inorganic Chemistry Division, performed analysis of solid crystalline material from reverse osmosis water purification unit, 14 February 1991. Clogging precipitates were forming on the reverse osmosis water purification unit membranes causing frequent maintenance and replacement of the membranes - affecting potable water supply. The precipitate was analyzed by x-ray fluorescence and x-ray diffraction and estimated to be at least 50 percent calcium sulfate (gypsum), 25 percent of a strontium compound and 25 percent of a silver compound. Impact: The water will have to be softened prior to the reverse osmosis treatment.

3-6. The Directorate of Laboratory Services provided services from 29 January - 25 February 1991 to Colonel Pearlman and LTC Ellis, 12th Medical Detachment, Riyadh. Technical consultation was provided to develop their ability to analyze drinking water. Equipment, laboratory supplies, standards and methods necessary in the analysis of water for organic and inorganic contaminants were shipped as follows:

- a. Package No. 1: Standards for volatile organics, 4 Megabore GC columns, EPA methods and in-house SOP's for analysis by pentane extraction and gas chromatography, chromatograms run in-house using the above columns, and 144 screw cap vials (1.8 ml).
- b. Packages No. 2 and 3: 5 gallons of high grade pentane.
- c. Package No. 4: 1 Tekmar LSC-2 purge and trap unit, 1 power cord, 1 Supelco 2-0321 trap (installed and conditioned), 2 hydrocarbon traps (one installed), 1 instruction manual and EPA methods, 2 purge vessels (25 ml), 2 purge vessels (5 ml), 1 syringe and luer lock (25 ml), and 1 bag spare parts (fuses, valves, ferrules).
- d. Packages 5 and 6: 400 vials for collecting drinking water (40 ml).
- e. Package 7: 1 HCL and ECD thallium lamp, 1 bottle T1 standard (250 ml, 1,000 μ g/ml).
- f. Package 8: Vials containing standard mixtures and individual pesticides.
- g. Impact: To provide onsite capability to screen the drinking water for a variety of contaminants in the laboratory in Riyadh, Saudi Arabia.

CHAPTER 4

KUWAIT



The Entrance to Kuwait



Highway to Hell

Section I. INTRODUCTION

4-1. GENERAL.

a. A major effort was expanded by USAEHA in evaluating the health risk of U.S. Armed Forces in Southwest Asia due to the oil smoke fires. This involved a massive in-field sampling effort coupled with a biological surveillance initiative followed by laboratory analysis and evaluation of both ambient air data as well as the medical surveillance data.

b. This Agency was tasked by OTSG at the request of DOD to conduct this health risk assessment. The USAEHA was the only organization within DOD with the capability to carry out this study. We joined forces with NOAA, EPA, and the Department of State as well as other scientific organizations in the collection of data and analyses to determine potential health risk not only to U.S. Forces but to the Kuwait population. (See Appendix G for the tasking memorandum, SGPS-PSP, OTSG, 12 April 1991, subject: Kuwait Oil Fire Health Threat - Information Memorandum enclosing Memorandum, The Office of the Assistant Secretary of Defense, 11 April 1991, subject: Environmental Health Monitoring and Risk Assessments - Kuwait Oil Fire Smoke).

4-2. PERSONNEL. The Deputy Commander, Colonel Gerald L. Delaney, asked for volunteers for temporary duty in Kuwait. A list of personnel who participated is shown on the following page.

Section II. HEALTH RISK ASSESSMENT

4-3. A health risk assessment was conducted to characterize the risk, both cancer and noncancer, to DOD and allied troops and civilians exposed to the environment effected by the oil fires during and after Operation Desert Storm. For further details refer to the Executive Summary of our Interim Report which is shown on pages 4-4 through 4-9

(Memorandum, HSHB-ME-S, USAEHA, 19 June 1992, subject: Interim Kuwait Oil Fire Health Risk Assessment No. 39-26-L192-91, 5 May - 15 September 1991.) The final health risk assessment will include the data analyzed from 16 September 1991 through 6 December 1991.

Section III. SAMPLING EFFORTS

4-4. ENVIRONMENTAL SAMPLING. An extensive environmental sampling and analysis effort in support of the Kuwait Oil Fires Health Risk Assessment was conducted from May through November 1991. This monitoring included the collection of over four thousand samples for laboratory analyses for chemical parameters of potential risk to the health and safety of military personnel stationed in the theater. Three general categories of sampling were performed at multiple sites in both Kuwait and Saudi Arabia: industrial hygiene sampling to monitor personnel exposures directly; ambient air sampling to characterize the atmospheric concentrations of pollutants; and soil sampling to determine potential hazards which could arise from respiratory or dermal contact with the surface soils.

4-5. INTEGRATED SAMPLING. Integrated sampling effort was conducted in the field by personnel from the Directorates of Environmental Health Engineering, Industrial Hygiene, and Laboratory Sciences; and the Direct Support Activities. Samples were taken on a regular basis at the various sampling locations, transported back to a central processing point at Dhahran, Saudi Arabia where they were packaged in shipping coolers with dry ice, and then sent from there by air express back to the USAEHA. Once they arrived at USAEHA, the samples were logged into the sample management system and distributed for analysis by the Analytical Quality Assurance Division to the appropriate laboratories of the Organic Environmental Chemistry Division and the Radiological and Inorganic Chemistry Division.

TABLE. KUWAIT TRAVELERS

<u>Name</u>	<u>Division</u>
LTC David P. Deeter	DOEH
LTC Wendell C. King	USAEHA-W
LTC George R. Murnyak	IHD
MAJ Richard Broadhurst	OEMD
MAJ Charles E. Goodman	USAEHA-S
MAJ Lester Y. Pilcher	APED
CPT Donald F. Archibald	WDDED
CPT Mark W. Bower	HPD
CPT David K. Gustavison	OEMD
CPT Elmer S. Kaiser	HHD
CPT Rodger J. Rudolph	WDDED
CPT Brian C. Scott	OEMD
CPT Clark H. Weaver	IHMO
1LT Robert C. Craft	USAEHA-S
1LT Brian W. Higgins	APED
1LT John A. James	USAEHA-S
1LT Robert B. Johnson	USAEHA-S
1LT David B. Martin	APED
1LT Kenneth R. Mead	IHD
1LT Emil J. Dzuray	WQED
1LT Delton L. Willis	IHD
SFC Scott G. Goodison	HPD
SSG Daneen E. Harris	PTMSD
SGT William B. Jones	RICD
SPC Shawn L. Pinsonneault	USAEHA-W
PFC Bryan Rudyk	USAEHA-N
Lawrence D. Clark	OECD
William W. Corbin, Jr.	BAD
Myrmuth B. Fortune	IHD
*Jack M. Heller, Ph.D.	WDDED
Michael P. Kefauver	RICD
Richard M. Lachiver, M.D.	OEMD
Glenn Lamson	HHD
Daniel Noble	OECD
Richard S. Price	WDDED
Joanne Schmith	OEMD
Nathan A. Shero	OECD
Edith L. Stunkard	AQAD
Anthony D. Wagner	RICD
Keith J. Williams	WDDED
Kenneth E. Williams	OECD

* Team Chief



DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-6422

REPLY TO
ATTENTION OF



HSHB-ME-S

19 June 1992

MEMORANDUM FOR HQDA(SGPS-PSP), 5109 Leesburg Pike, Falls Church,
VA 22041-3258

SUBJECT: Interim, Kuwait Oil Fire Health Risk Assessment
No. 39-26-L192-91, 5 May - 15 September 1991

Copies of subject report with Executive Summary are enclosed.

Encl

Ronald M. Bishop

RONALD M. BISHOP
Colonel, MS
Commanding

Nationally Recognized as the Center of Matrixed Occupational and Environmental Health Excellence

Interim Report, DO NOT RELEASE, Scientific Peer Review Proceeding, FOR GOVERNMENT USE ONLY



DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-6422

REPLY TO
ATTENTION OF



EXECUTIVE SUMMARY
INTERIM
KUWAIT OIL FIRE HEALTH RISK ASSESSMENT
NO. 39-26-L192-91
5 MAY - 15 SEPTEMBER 1991

I. PURPOSE. We conducted this health risk assessment (HRA) to characterize the risk, both cancer and noncancer, to DOD and Allied troops and civilians exposed to the environment effected by the oil fires during and after Operation Desert Storm. This interim HRA includes data analyzed during 5 May 1991 through 15 September 1991. The final HRA will include the data analyzed from 16 September 1991 through 6 December 1991.

II. CONCLUSIONS.

A. Health Risk Assessment.

1. Based on the air and soil pathway analysis results for the period 5 May 1991 through 15 September 1991, the total predicted excess cancer risk resulting from exposure to the Persian Gulf environment ranged from 2 per 10,000,000 (2E-7) to 5 per 10,000,000 (5E-7). These risk levels are for the eight permanent monitoring sites and include all exposure routes (i.e., inhalation, incidental ingestion, and dermal contact). These cancer risk levels are below the EPA range of concern of 1 per 10,000 (1E-4) through 1 per 1,000,000 (1E-6).

2. Cancer risk levels do not appear to differ significantly between the monitoring sites in Kuwait, near the oil fires, and the monitoring sites in Saudi Arabia. In fact, there is very little difference in the cancer risk levels between any of the sites monitored.

3. The total predicted noncancer risk is calculated by summing the hazard quotients for the individual contaminants of concern which results in a hazard index (HI). The noncancer hazard quotient assumes that there is a level of exposure or reference dose (RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. Thus, if the exposure level (E) exceeds this threshold (i.e., if E/RfD exceeds unity), there may be concern for potential noncancer effects. As a general rule, the more you exceed unity, the level of concern for noncancer risk likewise rises. The HI's for all pathways and routes of exposure to personnel in the Persian Gulf environment during 5 May 1991 through 15 September 1991 ranged from two times unity (2E+0) to four times unity (4E+0). Again, as with cancer risk levels, the noncancer risk

EXSUM, Interim, Kuwait Oil Fire HRA No. 39-26-L192-91, 5 May - 15 Sep 91

levels do not appear to differ significantly between any of the monitoring sites in Kuwait and Saudi Arabia. The HI's for noncancer risk did exceed the EPA level of concern of unity ($1E+0$) at all the monitoring sites in Kuwait and Saudi Arabia. The majority of noncancer risk at all the monitoring sites comes from the inhalation of metals, in particular chromium, which represents over 99 percent of the risk. This chromium contamination is believed to be from natural and anthropogenic sources, and not from the oil fires.

4. Background and historical environmental monitoring data from the Persian Gulf region, combined with industrial pollution data from various areas of the world, indicate that much of the risk associated with the region is not oil fire-related, but it is the result of regional background contamination.

B. Air Pathway Analysis.

1. Ambient air sampling in Kuwait and Saudi Arabia was completed in December 1991 after 7 months of monitoring for pollutants associated with the oil well fires. Nearly 4,000 air samples were collected during this period from 10 fixed ground-based sampling sites. The data reported in Appendix B represents concentrations determined from samples collected from 5 May through 15 September 1991. Samples collected from 16 September through 2 December 1991 will be analyzed and reported in the final HRA. Only the magnitude of human exposure has been determined so far. The frequency and duration of exposure will be addressed in the final HRA.

2. Based on the analysis so far, the database of air quality measurements collected during this project does not suggest that the oil fires were significantly contributing to a degradation of pre-war air quality at the sampling sites. In fact, comparing air quality data when the fires were burning with historical data indicates the air quality at ground level at some of the sampling sites was better in 1991 than in previous years for some pollutants. Although the percent contribution to air pollution levels from fire and nonfire sources cannot be presently determined from this database, it may be concluded, based on the limited data evaluated, that the fire pollutants may not have had a significant contribution.

EXSUM, Interim, Kuwait Oil Fire HRA No. 39-26-L192-91, 5 May -
15 Sep 91

3. Mean concentration values observed in Kuwait and Saudi Arabia for organic compounds were comparable to levels observed in Houston and Philadelphia, which are industrialized oil industry or petrochemical storage regions. In most cases, concentrations of polycyclic aromatic hydrocarbons were below the detection limit or at very low levels. Predictably high levels of particulate matter were measured at all sampling locations, but the concentration levels were considered "normal" for the particular area of the Middle East. Relatively high concentrations of naturally-occurring metals associated with wind blown surface soils were also observed.

4. The data indicates that while certain pollutants were found at elevated concentrations relative to U.S. air quality standards, the pollutant levels at ground level, where sampling occurred, were not as high as first predicted. This fact is somewhat surprising considering the magnitude of pollution released to the atmosphere from the damaged oil wells and the abundance of petroleum refining and petrochemical plants in the areas near Air Pollution Assessment Team sampling sites. The data demonstrates that regional air quality trends, as measured during this project, were more strongly influenced by site-specific factors such as terrain, geography, atmospheric dispersion, source characteristics, chemical fate, and meteorology and were not as strongly influenced by the extent of contamination (i.e., the emission rate) of the sources.

5. Due to the logistical constraints of the project, the sampling protocols and quality assurance/quality control procedures were redefined to increase the number of samples for interim analysis. These actions were required based upon field conditions encountered in Saudi Arabia and Kuwait. The final HRA will fully discuss the data validation process and the data used for HRA.

6. Modeling should be completed to estimate ground level atmospheric concentrations of fire-related pollutants during the time period when oil fires burned and air samples were not being collected by the U.S. Army Environmental Hygiene Agency (i.e., February, March, and April 1991). Concentration levels may be higher or lower during these months when compared with mean concentrations. It may be that concentrations during February through April for some oil fire pollutants are higher than those reported so far. This is hypothesized because 605 oil well fires were burning during this time period versus 580 oil well fires when sampling was initiated and the strong Shamal winds, which help to disperse pollution, usually display the greatest

EXSUM, Interim, Kuwait Oil Fire HRA No. 39-26-L192-91, 5 May - 15 Sep 91

intensity after May. To complete the dispersion modeling, surface and upper air meteorological data is needed from sources within DOD.

C. Soil Pathway Analysis.

1. There is no consistent increase in soil metals concentrations between sampling rounds one and two at the monitoring sites in Kuwait and Saudi Arabia.

2. The few increases in metals concentrations that occurred were mainly for metals not associated with Kuwait crude oil. Therefore, these increases are probably not fire-related but are of natural or anthropogenic background.

3. There were very few semivolatile target analytes detected in soil samples at the monitoring sites in Kuwait and Saudi Arabia. When detections occurred, they were related to common laboratory contaminants and usually present in the laboratory method blanks.

4. There were considerable detections of tentatively identified compounds (TIC's), but the most common of these were also associated with the method blank and attributed to solvent residues. There were some hydrocarbon TIC's detected at the monitoring sites that could be attributed to the oil fires and/or industrial activities.

5. There were no semivolatile organics in soil selected as contaminants of concern. This was due to the extremely small number of detections of target analytes and because those detected were considered laboratory contaminants.

D. Industrial Hygiene Air Sampling.

1. Industrial hygiene air sampling is the application of personal (i.e., breathing zone) and/or general area air monitoring in order to characterize concentrations of the contaminants of concern.

2. The industrial hygiene air sampling results showed no statistical difference between the outdoor occupational environment in Saudi Arabia and Kuwait.

EXSUM, Interim, Kuwait Oil Fire HRA No. 39-26-L192-91, 5 May -
15 Sep 91

3. The oil well fires in and around Kuwait City did have a measurable impact on the occupational environment in specific circumstances, based on local weather conditions and proximity to oil fire plumes. This impact was measurable by standard industrial hygiene air sampling methods used in the ambient environment.

4. The magnitude of the exposures were low compared to recognized occupational health standards. Adverse health effects would not be expected based on the assumptions inherent in such standards.

5. The question of long-term health risk is best answered by the accompanying comprehensive HRA.

III. RECOMMENDATIONS.

A. Update the HRA to include the monitoring data from 16 September 1991 to 6 December 1991 and the dermal route of exposure from the soil pathway when the information becomes available.

B. Update the HRA to include air modeling study results for DOD troop sites where no monitoring was conducted when the modeling and troop location information becomes available. This action will incorporate back trajectory modeling for the February through April time period and will also establish a series of contamination corridors for assessment of risk to displacing troop units.

C. Continue trying to separate natural and anthropogenic background risk from oil fire-related risk as more background, modeling, and particle analysis information becomes available.

D. Continue to update the HRA as new toxicologic information and cancer and noncancer risk assessment methodology becomes available.

E. Incorporate the Biologic Surveillance Initiative information with the HRA results to refine the findings and conclusions of the assessment.

4-6. AIR AND SOIL SAMPLING. The majority of the air and soil sampling and analyses were performed in accordance with established EPA, NIOSH, or OSHA guidelines. There were also several procedures used which followed methodology described in open literature publications or which were variations on standard procedures. There were a number of sampling media types used in the assessment; several of the more widely used included high volume filters, Tenax® cartridges, silica gel tubes, and charcoal tubes.

4-7. CHEMICAL ANALYSES.

a. Analyses were performed for a variety of organic and inorganic compounds. The principal analytes of interest in the ambient air samples were heavy metals, polynuclear aromatic hydrocarbons, toxic organics, acid gases, and EPA criteria pollutants. Industrial hygiene monitoring was primarily for organics, polynuclear aromatic hydrocarbons, acid gases, and Sox/Nox. There was also air sampling for particle size analyses and microscopic characterizations of particulates. Soils were analyzed for heavy metals and semi-volatile organic hydrocarbons.

b. A substantial number of quality controls were analyzed along with the samples as part of the quality assurance documentation. Controls consisted of field spikes, internal and external laboratory controls, duplicates, surrogates, mass spectral confirmations, etc. Chain-of-Custody was maintained on all samples from collection to completion of analysis. All laboratory results went through two levels of review prior to release to the project manager.

c. The successful completion of the sampling and analyses during this assessment involved the combined efforts of more than 60 people.

4-8. LOGISTICS.

a. The logistical problems associated with setting up a sampling network halfway around the world were formidable. The maintenance of fresh reagents, the collection of samples from locations spread out over Kuwait and Saudi Arabia, and the transport of these samples back to our laboratories

took extraordinary coordination. The long hours and irregular schedule of the chemists was a vital key in the success of this project.

b. A progression showing samples taken in Kuwait being prepared for shipment back to our laboratories is depicted in Appendix F.

Section IV. BIOLOGICAL SURVEILLANCE INITIATIVE

4-9. DESIGN AND INITIATION. While in Kuwait City, in May 1991, our scientists and physicians learned of the impending movement to Kuwait of an entire cavalry regiment. Acting on this unforeseen opportunity, senior USAEHA physicians urgently constructed a plan for medical testing of these soldiers, to augment the health risk assessment of oil well fire pollution, already underway. Together with Walter Reed Army Institute for Research, the Armed Forces Institute of Pathology, the U.S. Centers for Disease Control, the National Cancer Institute, and consultants from the Johns Hopkins University School of Public Health, a focused project, the Kuwait Oil Fires Health Risk Assessment Biologic Surveillance Initiative (BSI), was designed and initiated within 10 days.

4-10. SCOPE.

a. The biologic surveillance of the 11th Armored Cavalry Regiment (11ACR) is a novel effort in applied epidemiology and occupational and environmental medicine. USAEHA teams met three times with this regiment; before, during, and after their 90-day mission to Kuwait. For this, six-to-eleven member teams from the USAEHA traveled to Germany and Kuwait. Soldiers of the 11ACR completed questionnaires and breathing tests, and gave blood for special tests of exposure to potential oil well fire pollutants, at all three meetings. These tests are being completed in several laboratories around the U.S. They will reveal even the most minute exposure to oil well fire pollutants of health concern for the time of the 11ACR soldiers' stay in Kuwait. Some test results will also show the exposures to automobile exhaust, and the industrial background pollution of Kuwait.

b. The novelty of the BSI is, first, that it exists at all. No other agency, nation, university, or research entity has had the opportunity to accomplish such a sweeping measurement of exposure to the Kuwait oil fire pollution in humans. Second, results from the BSI will further enhance the excellent environmental characterization of the oil well fires' pollution performed by the USAEHA: biologic test results will serve as a double-check on the calculated human exposures derived from air monitoring. This is also a novel achievement in environmental medicine and engineering. USAEHA air monitoring was performed on the same site as the 11ACR bivouac during their stay.

c. In addition, the biologic testing provides a picture of the health of soldiers deployed to Kuwait, of extreme interest to senior Army and DoD leadership. Government agencies and some university researchers made numerous early predictions of dire health effects from the Kuwait oil fire pollution. Since the end of the war, Army officials have responded to many reports of ill-defined clusters of symptoms among returnees from Southwest Asia. The BSI affords a set of objective data of health and exposure, which will be of enormous benefit in elucidating any possible associations between oil fire pollution and soldiers' health.

d. The USAEHA professionals who designed and executed this project are still working on this important contribution to soldiers' health. The final report is in preparation.

Section V. PUBLICATIONS, NEWS ARTICLES AND PICTURES

4-11. STATUS REPORT. A Memorandum, HSHB-ME, USAEHA, 30 January 1992, subject:

Status Report of the Sampling Phase of the Kuwait Oil Well Fires Project, is shown in Appendix F.

4-12. PUBLICITY. Our Public Affairs Office received many requests. A local television station from Baltimore, Maryland, video-taped our first team's departure for Kuwait. In addition, articles listed below were published and are shown in Appendix F.

- a. U.S. Medicine, July 1991.
- b. Soldiers Magazine, September 1991.
- c. HSC Mercury, September 1991.
- d. American Forces Information Service, November 1991.
- e. Transcription of an Army Information Radio Service broadcast, November 1991.
- f. USAEHA Press Release, January 1992.

4-13. EXPERIENCES. Trip reports by Major Lester Y. Pilcher, Chief, Air Pollution Engineering Division; and Mr. Nathan Shero, Laboratory Worker, Organic Environmental Chemistry Division, are shown in Appendix F. The reports give details of their trips and some of their personal thoughts.

4-14. PHOTOGRAPHS.

a. In the final days of the Persian Gulf War, the setting afire of over 600 oil wells posed innumerable environmental and engineering challenges. Even the combustion products of adjacent oil wells could be quite different. The white plumed fires, indicative of oil wells impacted by salt water intrusion, burned cooler but with more products of incomplete combustion than its black plumed neighbor.

b. See Appendix F for a variety of photographs taken by our personnel of the oil well fires.



Captain Donald F. Archibald poses in front of a tactical fighter with an Arab and his son.

Section VI. DESERT HEALTH PHYSICS

4-15. EVALUATION OF POTENTIAL RADIATION HAZARDS. An article which was printed in the Agency's newsletter, the AEHA Sentinel, explains how Captain Mark Bower and SFC Scott Goodison of HPD visited Dhahran, Kind Khalid Military City and Camp Doha (Kuwait City) from 23 September to 4 October 1991. They established a dosimetry program, evaluated potential hazards from x-ray machines, provided a site plan for downsizing an evacuation hospital, and evaluated radiation hazards on captured Iraqi equipment. Refer to Appendix F for pictures and more details.

Section VII. SAND FOR GENERAL SCHWARZKOPF

4-16. Mr. Keith B. Hoddinott, Environmental Scientist, WDED, assisted General Norman H. Schwarzkopf with soil collected from the liberated beaches of Kuwait. The General wanted to keep the soil as a souvenir of the Gulf War. Refer to Appendix F to see the procedures involved.

Section VIII. EXCELLENCE IN ENVIRONMENTAL ENGINEERING

4-17. AMERICAN ACADEMY OF ENVIRONMENTAL ENGINEERS. In January 1992, we submitted an entry entitled "Environmental Characterization of the Kuwait Oil Well Fires" to the American Academy of Environmental Engineers. The purpose of the Academy's Excellence in Environmental Engineering competition is to recognize and promote quality environmental engineering.

4-18. PRINCIPALS. The principals were LTC Wendell C. King, P.E, Environmental Engineering; Jack M. Heller, PhD., Health Risk; CPT Brian C. Scott, M.D., Occupational Health; LTC George G. Murnyak, CIH, Industrial Hygiene; and Richard W. Bishop, Environmental Chemistry.

4-19. AN HONOR AWARD. The official entry form and a copy of the display are shown in Appendix F. On 15 April we were awarded an Honor Award for Planning which was presented at the Academy Awards Luncheon held in Washington, D.C.

CHAPTER 5

GENERAL

5-1. DESERT LIFE. Our troops called Saudi Arabia the Sandbox. The sand was everywhere. Water is vital in the desert; one soldier needs several gallons per day to survive. Pages 5-2 through 5-3 depict some of the life style as well as past times.

5-2. HOME AWAY FROM HOME. For a soldier in the field, cleanliness is as necessary as it is desirable. Washing and shaving in the open air are difficult under fairly primitive conditions. See pages 5-4 through 5-5.

5-3. USAEHA WOMEN IN THE ARMED FORCES. It was a big decision when Saudi Arabia's King Fahd made the decision to request Western intervention in the Gulf. It meant that men and women would walk on sacred Arabian soil. Saudi culture suffered a shock. Women were supposed to wear clothes that covered them - How did this affect our female soldiers? How did our women do in ODS?

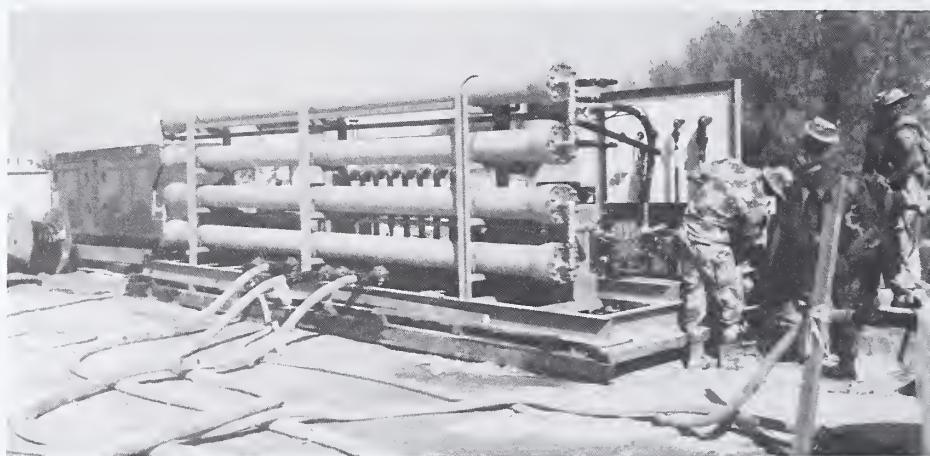
a. Captain M. Debra Parker. The following is extracted from Captain Parker's memo about her experiences in Saudi Arabia:

This place is strange. Women don't drive, they don't talk to men or look them in the eye, and they must wear a black robe called an abaya over a long dress or loose pants and a long sleeve shirt. Women aren't supposed to look enticing to the opposite sex. The local women must also cover their hair and faces, but we were told that it wasn't necessary for us to cover our faces. However, we are encouraged to cover our hair if it was red or blonde. The men dress in long white robes, "thobe," with a white or colored headdress, "guhtra." The women look like they're going to a funeral, and the men look like they're ready for bed. We were told not to go out except in groups

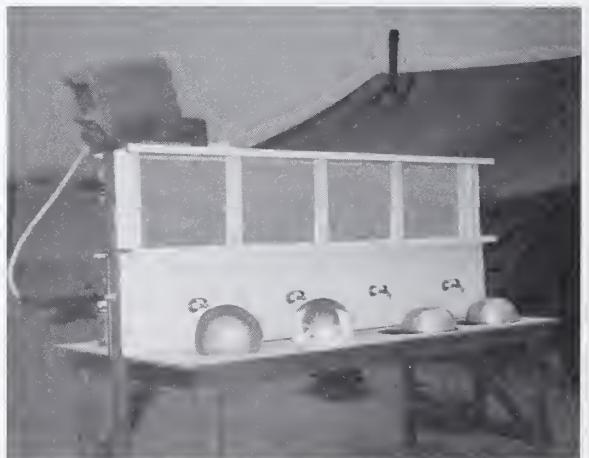
LIFE IN THE DESERT



Reverse osmosis and potable water distribution in the desert



Desert campsite has all the comforts of home



Washing facilities in the desert



Bedouin with his camels



Preparation of camouflage nets to be used to minimize enemy detection



Soldiers work to fill sandbags to build bunker



ILT (P) Forest holds his M16A1 while on guard duty



Preventive Medicine on the move

HOME AWAY FROM HOME



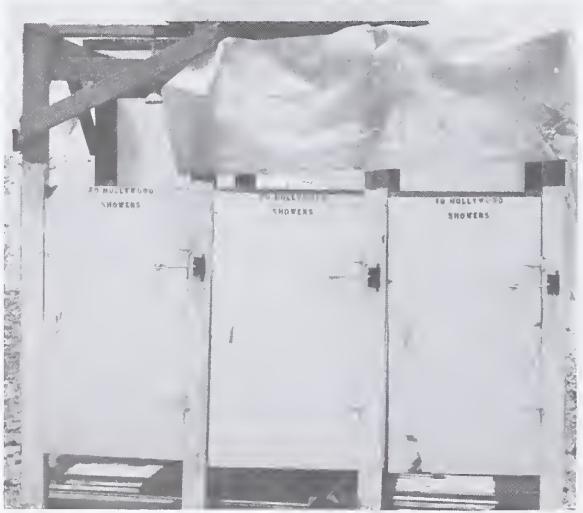
Separate latrines for males and females



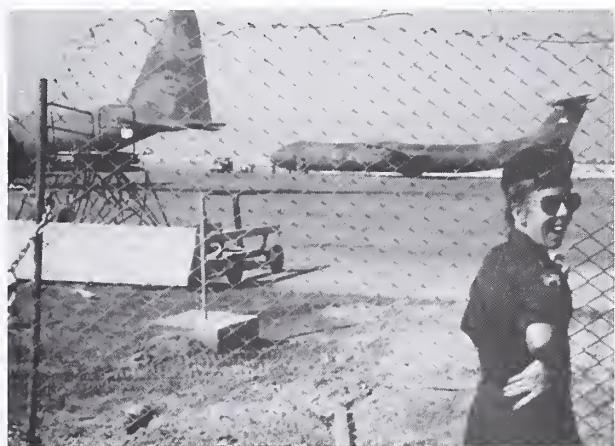
CPT Debby Parker stands outside the "Officers' Club" at Eskan Village in Saudi Arabia



Washing facilities leave a lot to be desired



1LT(P) Gerald Forest steps aboard the "Cunard Princess"



CPT Parker waits for a C130 to take her home



Shopping always reminds us of home



SPC Michelle McIntosh (bottom left) relaxes with friends outside a GP large sleep tent



We smoked a turkey on a 55-gal drum grill made by the Corps of Engineers



Desert barbershop -- No Waiting



Christmas in the desert "And the stockings were hung by the GP large with care"

and to always have a male with us. We were also told not to go out in a group if the number of men exceeded the number of women.

* * * * *

We had to abide by the local customs prohibiting females from driving, and it soon became evident that this imposed a hardship because it took at least two people away from the duty section every time a female had to go somewhere. The situation was negotiated. The results were that females, in uniform, with a hat on, could drive military vehicles on the base/post but not beyond the gates. This solution helped very little. Soon females were driving military vehicles from installation to installation in uniform with hats on. No one was quite sure if it was policy or just evolved but we were not challenged.

* * * * *

Jill and I spent hours in the gold and rug suks. Eventually we spent lots of money also. Our most clandestine adventure occurred in March when we dressed like a Saudi couple and drove downtown. We parked in a back alley so I could remove the male disguise and once again become a female. We used this several times to get around.

* * * * *

We transitioned over the next two weeks and were getting ready to leave when quite by accident we found out about the AFRC in Bahrain. It was a cruise ship being used for R&R purposes. We decided that it would be a nice transition period before returning home. We were allowed two days and three nights on board. Everything but beverages was included. It was a wonderful time to be a female because the men outnumbered the women eight to one. We didn't have to buy a drink. All we had to do was dance, talk, and eat with the

guys. I would have been in heaven if I had been a teenager and single.

b. SPC Michelle A. McIntosh. When the 82nd Airborne Division needed a medical laboratory specialist, they called the HSC. The HSC responded with a call to USAEHA requesting assistance, and I was chosen to represent the Agency.

I was sent to Fort Jackson, South Carolina, to be issued a weapon, mask and desert uniforms. Everything was hurry up and wait. Before leaving we had to requalify with the M16A1, get inoculations, and get all our records up-to-date. On Sunday morning we took a flight that landed in Philadelphia, Germany, and on to King Faahd Military City in Saudi Arabia. During the whole trip, we felt strange because we weren't allowed to leave the plane at any of its stops; we felt watched. Every ten minutes, we were counted to make sure we were all there.

Our 747 jumbo jet held 300 soldiers, all with weapons, load-bearing equipment, mask protective gear, and Kevlar helmet. We spent ten long minutes waiting to deplane because the airport was under a Scud attack. While we waited, we all had to don our protective clothing. It was our first experience with Mission Oriented Protective Posture, Level 2, but definitely not our last. When we finally got off the plane, we were taken to a reception area where we waited while our names were entered into a computer. We spent that night sleeping on the ground at the airport in our MOPP suits because Saudi Arabian bus drivers feared coming to the airport to pick us up. We were awakened three times that night to don our masks, waiting for the all clear signal so that we could take them off. Our bus finally came at noon the next day.

We always carried a gas mask with us in case of attack. We ate with our mask, and we slept with it. One of the soldiers even fell asleep in his mask after a Scud attack. After a while the gas mask became normal. It was no big deal.

Upon arrival at Cement City, our names had to be entered into another computer to confirm our assignments. I remember thinking, "Just send me back to the States so that I can sleep in a bed!" No such luck. After being transported back near the airport and spending two days with members of the 82nd Airborne Division at a water treatment

facility, we finally boarded a C130 for King Khalid Military City. Upon arrival at KKMC, I found out that I was assigned to the 86th Evacuation Hospital which had been in country for three months prior to my arrival. My reception there was a lot smoother and less confusing than when I first arrived in country.

We arrived on the compound late Friday night and turned in our weapons and ammunition. That night I slept in a General Purpose tent, large, with 16 other females, on a cot that occupied a space that was a plank and a half wide (about four and a half feet). I didn't complain; I was just glad to finally have a place to rest my head.

The next day, I went to work in the laboratory of a 500-bed hospital. I had never seen a field hospital before, but I was impressed with what I saw. I never imagined a field hospital having such automation, but I was ready to work. We worked six days a week for twelve hours a day. Those were long hours, but it didn't matter because we had nowhere else to go. It wasn't until after the cease fire that we slowed down to eight-hour days, five days a week.

I did all the things I had been trained to do: urinalysis, complete blood chemistry, pregnancy tests (we used so many of these that we ran out). During my shift I was given a chance to work and observe other parts of the hospital. The most interesting to me were the operating room and the x-ray laboratory. I saw a lot and helped out when needed. I learned a valuable lesson while I was there: you may be a laboratory technician, but in times of crisis, you could very well be an operating room technician.

We had a separate waiting room for men and women. This extended to separate facilities for male and female doctors. In the cafeteria, men were always served first. The game room had separate areas for men and women. Other facilities could only be used by women on certain days. It was a week before I saw a woman who was not with our unit. She was a Filipino who worked at the hospital. It seemed like they hid their children from us. We had to live with the Saudi customs, but it was really different. During the holy month of Ramadan, we were not even allowed to smoke, eat, or drink outside because it would show disrespect for their customs.

Our compound consisted of 12 GP large tents on a line with a GP small for the gym and two GP large for the showers. In front of the first row of tents were latrines that were like outhouses except instead of having a hole dug in the sand, it was a metal drum cut in half. We did have lots of toilet paper.

My most embarrassing moment in the desert happened on my first day off. I awoke that morning in the middle of a sand storm, but I just had to use the latrine. As soon as I entered the latrine, I felt it rattling and shaking. When I turned to open the door, a strong gust of wind just came along and lifted the latrine off the ground. I had just enough time to bend over and let the latrine flip over my head. For the rest of the week I was teased by everyone who heard the story, and all I could do was laugh with them.

Taking a hot shower in the desert was a luxury that we were lucky to have. We had hot water each and every day. Showers were a long pipe with four spigots on each side, eight in all. Our shower time was an hour and a half for females and an hour for guys. The guys didn't like it at all because they showered last and by then, we females had used all the hot water.

On Saturdays, we would put up clothes lines to hang up the clothes we just washed. Frequently, the wind would come up and the sand would make the clothes dirtier than before they were washed. Everything was dirty from sand all the time.

We were issued two Meals, Ready-To-Eat, each day. In addition, we had a mess tent where a hot breakfast was served from 0600 to 0730 each day. We had as much water as we needed. It was kept in the center of the compound, and we took what we wanted. Each person was required to have at least one box of water in his sleeping area. Apart from the usual water, we had Saudi Arabian fruit juices and Coca Cola. It wasn't as sweet as the regular Coke, and it sure didn't taste the same as home. After weeks of MREs, lunch buckets, and A rations, we began to invent creative ways to make our food more tasty. We came to look forward to "Wolfeburgers" when they were available. Designed by a food service warrant officer, Wolfeburgers provided a taste of home for the soldier, a place to use extra cooks assigned to various units, and creative, safe food. We were advised not to eat the local food.

My most memorable day ended with a bang. We never had Scud attacks during the day, but this day was an exception. I was waiting for one of my girlfriends in her tent before going to dinner in the mess tent. Then there was an explosion that shook the compound. It was followed by more explosions. I thought for a second that I was in a war movie, and it was just too loud and too close for comfort. Immediately, the alarms went off on the compound, and we were instructed to don our protective masks. Mine was already on! I stuck my head through the flaps of the tent, and as I looked up into the sky, I saw two Patriot missiles intercepting two Scud missiles. The explosions were a relief, and I just stood and watched as the smoke trailed across the sky. No one slept that night. Two days later, we heard the news of the barracks that was hit by a Scud missile. I thought, "that could have been me, but Someone was watching out for me."

Before the cease fire, we were not permitted to go downtown. Transportation was restricted. Later you had to have a male drive you off the compound. Many of us went to Half Moon Beach the week before I left. I think most of us went for the food even though the beach was very pretty. During the visit we tried tiny pizzas, hamburgers, lots of rice, pita pockets, and some fantastic chicken fried in batter with some unusual seasoning. We also went to the suk, the shopping area. Here we finally saw some Saudi women, but they were dressed completely in black and always kept their heads down. Here we were able to buy gold jewelry, prayer rugs, figurines, and Saudi head wraps. It was inexpensive and fascinating.

The day before I left, I pulled guard duty at an American dump site. We were told that our excess

equipment and trash would disrupt the Saudi market if we sold it or gave it away, so everything had to be burned. Our orders were to shoot on sight anyone coming over the fence. It was a four-hour duty, and all the time, the natives would wait for us to turn our backs so they could steal something. One of the natives had been to Baltimore to study computers, and he talked to us about home and asked us questions. Another man wanted to take some of our used wood to build another hut. He wanted another wife, and another hut would mean that he was a rich man.

We had a 22-hour flight home. The plane was decorated with ribbons and banners thanking us for a job well done. We had a stopover in Scotland, and our plane was parked right next to a Russian plane. We bought beer for the first time in six months, and others bought souvenirs and talked with the natives. Our second stop was at Kennedy Airport in New York where we were sent to a secluded part of the airport and supplied with pizza and drinks. Our final leg of the journey brought us to Fort Campbell, Kentucky, where we were greeted by friends and families.

Sometimes I wonder why I was chosen to go over there. I have heard many explanations as to why I was chosen, but whatever the reason, I am glad to have been the one. It was a once in a lifetime experience. I wasn't at home watching the action on the TV, I was there in the midst of it all. I have a much greater appreciation for life as we know it today. Many of the things we threw away were things they needed most. Our freedom to do and go at will are things others would die to have. We live in a very rich country and take a lot for granted, but we don't realize it until we lose it.

WOMEN IN THE ARMED FORCES

WOMEN IN THE ARMED FORCES



CPT Debby Parker in her office in Eskan, Saudi Arabia



CPT Debby Parker boards the "Cunard Princess" for some much needed R&R



Sightseeing



SPC Michelle McIntosh and friend sit on a litter during a break



ILT Jill Von Rothe models an abaya



CPT Debby Parker examines rugs at the suk in Riyahd



CPT Debby Parker offers a treat to a Saudi Arabian camel

APPENDIX A

PERSONNEL

1. Recognized, Authorized, and Actual Strength of Personnel:

	Recognized			Authorized			Actual		
	OFF	EM	CIV	OFF	EM	CIV	OFF	EM	CIV
Beginning of Year	161	68	597	113	52	374 + 6*	119	53	412 + 25*
End of Year	161	66	599	114	54	377			484 + 37*

* temporary appointments

2. Personnel Occupying Key Positions:

Position	Name	Incumbency
Commander	COL Ronald M. Bishop, MS	31 Aug 90 -
Scientific Advisor	Stephen L. Kistner	1 Apr 91 -
Safety Manager/Env Coordinator	Mr. Creighton P. Jacobson	6 Sep 82 -
Internal Review and Audit Compliance	Mr. James G. Rosenberger Ms. Lucille Oldland	18 Mar 85 - 12 Jan 91 5 May 91 -
Radiation Protection Officer	CPT Gary J. Matcek, MS	24 Oct 89 -
Adjutant	1LT Finest Harper, MS	18 Sep 90 -
NCOIC	MSG Kenneth V. Varner	15 Dec 90 -
Acting Inspector General	MAJ Douglas Rinehart, MS MAJ Alan K. Thompson, MS	9 Mar 87 - 21 Jun 91 16 Aug 91 -
Public Affairs Officer	Ms. Evelyn B. Riley	12 Dec 87 -
Chief of Staff	COL Frederick W. Boecher, MS COL Ernest L. Hepler, Jr., MS	5 Jul 89 - 7 Apr 91 8 Apr 91 -
Chief, Executive Administrative Office	Ms. Evelyn B. Riley	1 Oct 89 -
Chief, Resource Management Division	Mr. Thomas R. Bender	30 Jan 89 -
Chief, Logistics Division	MAJ Louis P. Chiasson, MS MAJ Reginald B. Sandifer, MS	18 Jun 86 - 13 Jul 91 14 Jul 91 -
Chief, Plans, Training, Mobilization and Security Division	Mr. Ray R. Fender	19 Dec 88 -
Chief, Information Management Division	Mr. Blaine L. Plummer	1 Oct 87 -

Position	Name	Incumbency
Deputy Commander for Mission Services	COL N. Joe Thompson, MC COL Gerald L. Delaney, MS	19 Sep 88 - 11 Apr 91 8 Apr 91 -
Chief, Special Document Development Office	Ms. M. Barbara Weyandt	1 Sep 87 -
Director, Occupational and Environmental Health	COL N. Joe Thompson, MC LTC David P. Deeter, MC	19 Aug 85 - 11 Apr 91 12 Apr 91 -
Occupational Health Management Information System Product Manager	COL Donald R. Ciliax, MS	26 Jul 89 -
Occupational Health Management Information System Functional Program Manager	Dr. Loretta A. Dash	Apr 88 -
Director, Residency Program Office	LTC David P. Deeter, MC	8 Aug 88 -
Chief, Health Hazard Assessment Office	MAJ Gary L. Shrum, MS MAJ David Tompkins, MS	8 Oct 90 - 22 Apr 91 24 Jul 91 -
Chief, Occupational and Environmental Medicine Division	LTC David P. Deeter, MC LTC David M. Wilder, MC	30 Jun 90 - 11 Apr 91 12 Apr 91 -
Chief, Bio-Acoustics Division	COL Kenneth B. Aspinall, MS	15 Aug 90 -
Chief, Toxicology Division	Mr. Maurice H. Weeks	8 Aug 83 -
Director, Environmental Health Engineering	COL Gerald L. Delaney, MS COL Frederick W. Boecker, MS	1 Sep 87 - 7 Apr 91 8 Apr 91 -
Chief, Water Quality Engineering Division	LTC Robert S. Ryczak, MS	9 Aug 90 -
Chief, Air Pollution Engineering Division Acting Chief, Air Pollution Engineering Division	MAJ Lester Y. Pilcher, MS	8 Dec 85 - 31 Jul 91
Chief, Air Pollution Engineering Division	Mr. David L. Daughdrill LTC James J. Evenden, MS	5 Aug 91 - 2 Dec 91 6 Dec 91 -
Chief, Waste Disposal Engineering Division	LTC Paul R. Thies, MS LTC William T. Broadwater, MS	1 Sep 87 - 30 Jun 91 1 Jul 91 -
Director, Radiation and Entomological Sciences	LTC Ernest L. Hepler, Jr., MS COL Charles E. Day, III, MS	1 Mar 90 - 7 Apr 91 1 Aug 91 -
Chief, Laser-Microwave Division	MAJ David P. Alberth, MS	29 Mar 89 -
Chief, Health Physics Division	LTC Michael W. Mueller, MS	1 Jul 88 -
Chief, Entomological Sciences Division	LTC Michael W. Hastriter, MS	1 Mar 90 -
Director, Industrial Hygiene	LTC George R. Murnyak, MS COL Gerald L. Delaney, MS	16 Jun 90 - 7 Apr 91 8 Apr 91 -
Chief, Worksite Hazards Management Division	MAJ Gary M. Bratt, MS LTC George R. Murnyak	1 Oct 88 - 7 Apr 91 8 Apr 91 -
Chief, Healthcare Hazards Management Division	MAJ Anthony C. Aiken, MS MAJ Michael J. Testa, MS	8 Oct 90 - May 91 20 May 91 -
Chief, Sanitation and Hygiene Office	MAJ Michael J. Testa, MS CPT W. Michael McDevitt	24 Jul 90 - 17 May 91 15 Jul 91 -

Position	Name	Incumbency
Chief, Installation Industrial Hygiene Management Office	Ms. Sandra P. Arnold	1 Sep 90 -
Director, Laboratory Services	COL William G. Kavanagh, MS	17 Aug 87 -
Chief, Organic Environmental Chemistry Division	MAJ Douglas S. Rinehart, MS Mr. Frederic Belkin	9 Mar 87 - 21 Jun 91 5 Aug 91 -
Chief, Radiological and Inorganic Chemistry Division	Dr. Roger E. Boldt	14 Nov 88 -
Chief, Analytical Quality Assurance Division	Mr. Timothy L. Fisher	16 Jun 86 -
Commander, USAEHA - North Fort George G. Meade, Maryland	COL Dan E. Hammack, MS LTC Steven J. Stone, MS	4 Aug 89 - 24 Apr 91 25 Apr 91 -
Chief, Environmental Health Engineering Division	MAJ Thomas F. Allen, MS MAJ Robert D. Plakus, MS	22 Jul 90 - 13 May 91 21 Oct 91 -
Chief, Entomological Sciences Division	MAJ James T. Kardatzke, MS	28 Jul 90 -
Commander, USAEHA - South Fort McPherson, Georgia	LTC Douglas L. Watson, MS LTC Joseph A. Jakubowski, MS	28 Jul 89 - 18 Jul 91 22 Jul 91 -
Chief, Environmental Health Engineering Division	MAJ John W. Calvert, MS	3 Dec 86 -
Chief, Entomological Sciences Division	LTC Darwin B. Palmer, Jr, MS MAJ Michael R. Collyer, MS	13 Apr 90 - 15 Jul 91 16 Jul 91 -
Chief, Environmental Laboratory Division	Dr. Joseph E. Wreen, Jr	27 Jan 90 -
Commander, USAEHA - West FAMC, Aurora, Colorado	LTC Edward T. Bartosh, MS	19 Jun 90 -
Chief, Environmental Health Engineering Division	LTC Wendell C. King, MS MAJ Bobby R. Templin	26 Jul 88 - 18 Oct 91 19 Oct 91 -
Chief, Entomological Sciences Division	LTC Ronald J. Rakickas, MS	1 Jun 86 -
Chief, Environmental Laboratory Division	Mr. David F. Morrow	20 Dec 87 -
Chief, Cholinesterase Laboratory Division	MAJ Carroll R. Dotson, MS	1 Jun 90 -

APPENDIX B

GLOSSARY

ACE	Airlift Control Element
ACGIH	American Conference of Governmental Industrial Hygienists
ADA	Air Defense Artillery
AECC	Aeromedical Evacuation Control Center
AES	Aeromedical Evacuation Squadron
AFB	Air Force Base
AIT	Advanced Individual Training
AMC	U.S. Army Materiel Command
APED	Air Pollution Engineering Division
APG	Aberdeen Proving Ground, Maryland
AQAD	Analytical Quality Assurance Division
ARCENT	Army Central Command
BAD	Bio-Acoustics Division
BDU	Battle Dress Uniform
CARC	Chemical Agent Resistant Coating
CFR	Code of Federal Regulation
COE	Chief of Engineers
CONUS	Continental United States
CPO	Civilian Personnel Office
CSG	Corps Support Groups
CSS	Combat Service Support
DEH	Directorate of Engineering and Housing
DEPMED	Deployable medical
DLS	Directorate of Laboratory Sciences
DOD	Department of Defense
DOEH	Directorate of Occupational and Environmental Health
DU	Depleted Uranium
EAC	Echelon Above Corps
EPA	U.S. Environmental Protection Agency
EPW	Enemy Prisoner of War
FDA	Food and Drug Administration
FORSCOM	Forces Command
GEV	General exhaust ventilation
GP	General purpose

HDU	Heads up display units
HHD	Healthcare Hazards Division
HHIM	Health Hazard Information Module
HMIS	Hazardous Material Information System
HPD	Health Physics Division
HSC	U.S. Army Health Services Command
IDLH	Immediately dangerous to life and health
IHD	Industrial Hygiene Division
IHMO	Industrial Hygiene Management Office
IH	Industrial Hygiene
IH&S	Industrial Hygiene and Safety
JMRO	Joint Military Regulating Office
KKMC	King Khalid Military City
KTF	Kuwait Task Force
KTO	Kuwaiti Theater Operation
LCBPG	Lightweight Chemical and Biological Protective Garment
LEV	Local exhaust ventilation
LTF	Logistical Task Force
MAC	Military Airlift Vehicle
MBAS	methylene blue activated substance
MCL	maximum contaminant level
MOHV	Military Occupational Health Vehicle
MOPP	Mission Oriented Protective Posture
MRE	Meal, Ready-to-Eat
MRS	Main Supply Route
NBC	Nuclear Biological and Chemical
NBCRS	Nuclear Biological and Chemical Reconnaissance System
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NVG	Night vision goggles
ODS	Operation Desert Shield/Operation Desert Storm
OECD	Organic Environmental Chemistry Division
OEMD	Occupational and Environmental Medicine Division
OSHA	Occupational Safety and Health Act/Administration
OTSG	Office of The Surgeon General

PM	Preventive Medicine
PMU	Preventive Medicine Unit
POL	Petroleum, oil, and lubricant
POW	Prisoner of War
PPE	Personal protective equipment
PROFIS	Professional Filler System
PTMSD	Plans, Training, Mobilization and Security Division
PVC	Polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RICD	Radiological and Inorganic Chemistry Division
ROWPU	Reverse Osmosis Water Purification Unit
RTP, NC	Research Triangle Park, North Carolina
SA	Saudi Arabia
SASCO	Saudi Arabia Services Company
SWA	Southwest Asia
TAC	Tactical Air Command
TB MED	Technical Bulletin Medical
TG	Technical Guide
TOE	Table of organization and equipment
TLV	Threshold limit value
TSU	Telescopic units
TWA/TLV	Time weighed average concentration for a normal workday or 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse health effect
USAEHA	U.S. Army Environmental Hygiene Agency
USAEHA-N	U.S. Army Environmental Hygiene Activity - North
USAEHA-S	U.S. Army Environmental Hygiene Activity - South
USAEHA-W	U.S. Army Environmental Hygiene Activity - West
WDED	Waste Disposal Engineering Division
WQED	Water Quality Engineering Division
WRMAG	Water Resources Management Action Group

APPENDIX C

USAEHA SOLDIERS

AT ANNUAL FTX



The FTX included training in proper helicopter loading procedures, for both litters and passengers.





After practice in the classroom, the soldiers were tested in the field to assure that they had properly donned the MOPP gear.



Soldier "zeros" his M16A1 prior to qualifying with the weapon.



LTC Luther Solverson (left) checks his target after qualifying with the M16A1.



Soldier practices donning Level IV Mission Oriented Protective Posture (MOPP) gear.



The M17A1 protective mask is donned by a soldier.



SGT William Menzel practices using an atropine injector like those used in case of exposure to nerve agents.



"The Weaponeer," an electronic device for teaching proper breathing and firing techniques to soldiers learning how to zero and shoot a weapon, is examined by AEHA soldiers.



SPC Sandra Littlejohn practices marksmanship using the weaponeer.

APPENDIX D

ORIGIN OF YELLOW RIBBONS REMAINS ELUSIVE

By Stephen Grieco

WASHINGTON (ARNEWS) -- You found them hanging on doors, tied to cars and trees, pinned to lapels, printed on T-shirts, worn in women's hair and splashed on billboards and television commercials. From coast to coast, yellow ribbons were everywhere.

As the story goes, using a yellow ribbon to symbolize support for the military is a tradition that dates back to the Civil War. Soldiers' wives would wear a ribbon that corresponded to the colored piping on their husband's blue uniforms -- red for artillery, light blue for infantry and yellow for cavalry. These ribbons would be displayed when the soldiers were on duty away from home. This is a popular romantic explanation of the yellow ribbon phenomenon, but it may not be true.

According to researchers from the Library of Congress American Folk Life Center, there is no historical evidence to support the Civil War origin of this revitalized tradition. Instead, they attribute these stories to the influence of the 1949 John Ford film, "She Wore a Yellow Ribbon," starring John Wayne as a U.S. Cavalry captain in 1876. The picture was popular and the theme song "(A'Round Her Neck) She Wore a Yellow Ribbon," became a hit. It is this song and its many renditions that seem to hold the secret symbolic history behind the yellow ribbon.

The lineage of the song goes back even further than this. Researchers from the Folk Life Center found a reference to a similar song in Shakespeare's original "Othello," from where it evolved into a 16th century English ballad. It first appeared in America as a folk song around 1838. It was at this time that some believe the song was adopted by soldiers as a marching cadence, one that most soldiers will remember from basic training.

Yellow was probably used in one of the many college variations of this song, but it wasn't popularized until after the 1949 movie. The Andrews Sisters recorded a contemporary version in 1953 that sold millions. However, it was the marching version that inspired Irwin Levine and L. Russel Brown to write a completely different version in 1972. "Tie a Yellow Ribbon 'Round the Old Oak Tree," is a story about a convict, not a soldier, returning home to his sweetheart. The Folk Life Center found recordings by some 30 vocalists in the 1970s, including the 1973 hit by Tony Orlando and Dawn. It is this version that many refer to when attempting to analyze the significance of yellow ribbons, but the correlation is still unclear.

Despite having the yellow ribbon song from Shakespeare to Tony Orlando, all this arduous investigation and research fails to show the relevance of these old songs to the symbolic support seen today. Though there are apparent similarities, historians still have found no documented proof.

Maybe a precise explanation isn't necessary. Perhaps it was all of these influences that have made the yellow ribbon a modern symbol of support, as it was in 1981 when the hostages were returned home from Iran. Such a simple, nonverbal gesture is inoffensive, nonconfrontational and aesthetically pleasing.

APPENDIX E

SUPPORT FOR THE TROOPS

INFORMATION DESERT STORM

SUPPORT FOR THE TROOPS

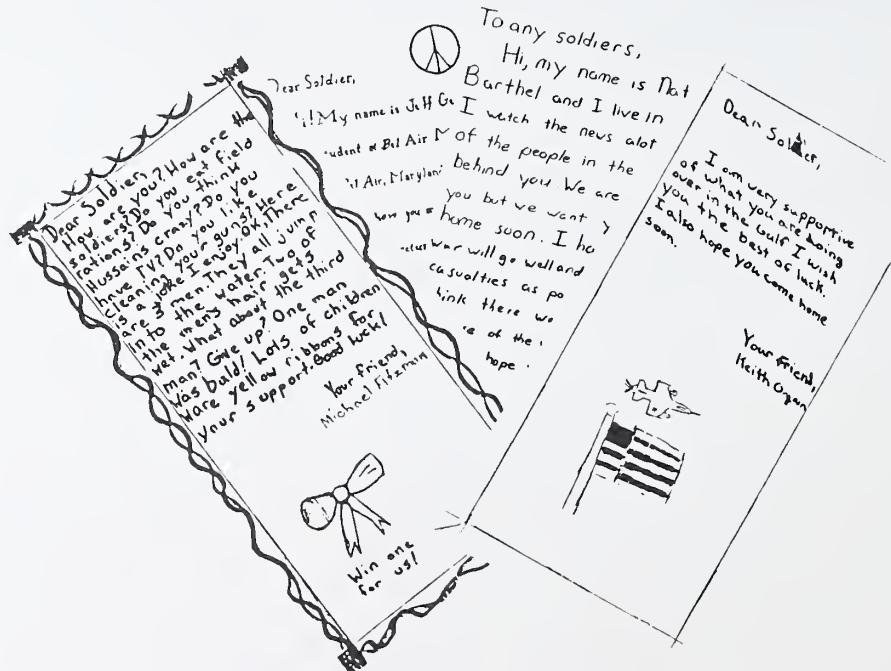
By: Evelyn B. Riley

One of the main concerns for our troops in Saudi has been safe drinking water. Certainly, it is part of AEHA's mission to support the troops in this endeavor. So, since we couldn't provide H₂O itself - we did the next best thing and provided containers.

It all started when Susan Millette, Organic Environmental Chemistry Division, approached Colonel Bishop, Commander, AEHA, and asked if she could work on a special project. A local Pepsi Cola distributor donated 4000 squeeze containers to AEHA to be shipped to troops in the Gulf. We in turn asked all of our friends and the local schools to write letters to put in them. SFC(P) Kenneth Varner, First Sergeant, played a key role in orchestrating the various aspects including all of the logistics.

Volunteers came out of the woodwork - or at least it seemed that way when we asked for help on Saturday, February 9, to package letters going to Saudi. What an exciting time as volunteers wrapped letters, cartoons, and valentines around the containers. The letters were written by friends, co-workers, and school children from Maryland, Delaware, and Pennsylvania. Yes, we had one for each container.

Colonel Bishop made arrangements with a specific commander in the Gulf who is eagerly awaiting the arrival of the containers. We are all proud of the team work for this worthy cause. The shipment left AEHA on 11 February. Those who took the time to write will surely be rewarded and may even receive an answer from "Any Soldier in Saudi". It was an experience that will never be forgotten.



These letters are to "Any Soldier" from students
at Bel Air Middle School.

CARNEY ELEMENTARY School

✓/o L. WALKER

E JOPPS Rd

Baltimore Md
21234

22 Nov 91

Dear Lynda,

I received your letter a couple of weeks ago but since I was told I was going home soon I thought I would write you from Gainesville. The Army did it again. I left Dhahran alright but I was just transferred to a different unit. I'm now with the 22nd Ord BN at King Khalid Military City, K.K.M.C. for short. It is about 50 km SSW of Hafar al-Batin. This is where the supplies for the end run, that ~~was~~ bought the end of the war, were staged. There is still some ammo here but everything else is pretty much gone. I'll be here for at least a month or two. My 6 months is up on Jan 28.

I have only received a letter from Michael, I was really glad to get it. Of course I was happy to receive yours too. I would like it very much if some of your students would like to write me. We put Gao Chien's picture on the wall of my room tell him thank a lot.

I've got to write a couple of more letters and it is getting later. Thank again.

Your audi Pal.

Greg.

P.S. Happy Holidays (that covers Halloween, Thanksgiving, Christmas, and New Years.) I figured it should be in Halloween too.

MAIL CALL

Recognizing that mail call in a foreign theater of war is a surefire morale-booster, USAEHA did its part in contributing to the delivery of mail to front-line troops. School children in our local community are still hearing from soldiers who are or were in the Gulf as evidenced by this letter.

Soldier to Students

By: Evelyn B. Riley

Eighteen classes from Carney Elementary School in Baltimore County, Maryland, responded to AEHA's request for letters to the troops in Saudi Arabia.

On April 8, SSgt. Scott G. Goodison visited the school to talk to the children, lead them in the Pledge of Allegiance, and participate in a flag-raising ceremony. He talked to approximately 200 children.

Goodison found the children very impressive and was amazed at their knowledge and their grasp of current events in the Gulf. He answered their questions, which included: Why did they spill oil in the Gulf? How long does it take to put out an oil fire? How many oil fires are there? What is it like to be in the Army? Where do soldiers live? What do soldiers eat? Have you ever flown a jet? What kind of guns does the Army have? How long does it take to get to Saudi Arabia? How does the equipment get there? How many countries were on our side?

Some questions were more difficult: How many people were killed? How many animals were killed? Where is



Where Do Soldiers Live? - *SSgt. Scott G. Goodison explains to second graders at Carney Elementary School about life in the military*

Saddam now? Does he live underground? How do soldiers know when to go to war? How much did the war cost?

He explained to the children that soldiers take an oath and will do what the president says. He also explained to one little boy the reason for the yellow ribbons -- about the movie "She Wore a Yellow Ribbon" and how Tony Orlando had a popular song in the 1970s about tying yellow ribbons around the old oak tree.

"I really enjoyed talking to the children and I was proud to represent the Army," Goodison said. "These children are not exposed to the military as are the children in Harford County. None of their parents are associated with the Army. It was a real experience for me and I think for them to just sit and talk."

Haute Cuisine:

Scud buster stew

By: Jane Gervasoni
Staff Writer

Armed Forces Day provided an opportunity for AEHA to show off a display of desert foods. The display was an introduction to the Army's efforts at troop feeding -- 12 menus of Meals, Ready-to-Eat (MRE). If you were one of the lucky ones to visit MAJ Michael Testa's display, you've already learned about this innovative method of feeding the troops.

"Food is a great morale booster," declared MAJ Testa, chief of the Healthcare Hazards Management Division. "During the troop deployment in southwestern Asia, the troops trained while waiting for something to happen, and interesting food filled a gap for them." Thus, the Army provided MRE, designed to promote good nutrition and performance for the troops. These meals consisted of prepackaged pouches of entrees, deserts, crackers, bread, and other items designed to make life and eating more comfortable in the desert.

"The scope of the problems faced by the designers of MRE was enormous," he explained. Packaging had to be designed to keep out bacteria, withstand chemical agents, and provide a psychological lift to the soldiers. Special attention was required to eliminate the need for refrigeration and minimize the need for special heating. Although there were some dining facilities available, many of the soldiers faced days of sitting in their tanks with only MRE. The available facilities were usually operated by the Army with some staffed by locals. "Their concepts

of hygiene, food service sanitation, and food preparation are very different," maintained MAJ Testa, "Sometimes they turned up with some really strange combinations of foods causing constant vigilance to prevent food-borne illness."

And then came... "Move over McDonald's; here come Woleburgers." Designed by a food service warrant officer, Woleburgers provide a taste of home for the soldier, a place to use extra cooks assigned to various units, and creative, safe food. Another innovative idea was Meals, Ordered, Ready-to-Eat. These were contingency meals used to deal with shortages, and they consisted of commercial, off-the-shelf foods complete with fancy American packaging.

"Many of the WWII vets who visited the food display at Armed Forces Day wondered what happened to C-rations," said MAJ Testa. The individual-serving C-rations of WWII grew into the multi-portion T-Rations, meal modules designed to feed 12 to 18 people

"Many of the WWII vets who visited the food display wondered what had happened to C-rations"

MAJ Michael Testa

and packaged in special containers to be "heated on the run."

The important thing about all these meals was the emphasis on health. Prevention of disease was of primary importance in preparation and practice. No more cigarettes, just plenty of healthy food. Included were matches, wet wipes, and other necessary items, including tiny bottles of tabasco sauce designed to perk up even uninteresting food. New and interesting food supplies helped make Desert Shield/Desert Storm a little easier on our soldiers.



"Peanut Butter and jelly anyone?"

APPENDIX F

KUWAIT



1) Kenneth E. Williams (left) and Anthony D. Wagner prepare quality control



4) Daniel G. Noble delivers samples to the overseas courier



2) Daniel G. Noble prepares internal quality control



5) Kenneth E. Williams, Daniel G. Noble, and Anthony D. Wagner (l to r) load samples for overseas shipment



3) Kenneth E. Williams, Daniel G. Noble and Anthony D. Wagner (l to r) prepare samples in shipping container



6) Gene Sinar (left) and Carolyn M. Miller receive shipment of samples

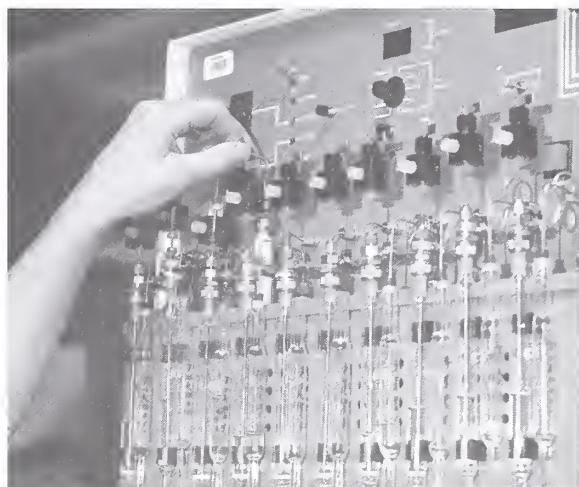
Processing samples taken in Kuwait for shipment back to our laboratories



9) Ambient sampler for volatile organics



7) Geraldine Miles desorbs passive monitors



10) Thermal desorber used for analysis of tenax



8) Richard J. Moore analyzes poly-aromatic hydrocarbons



11) Array of sampling media used



DEPARTMENT OF THE ARMY
U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MARYLAND 21010-6422



REPLY TO
ATTENTION OF

HSHB-ME

30 January 1992

MEMORANDUM FOR HQDA[SGPS-PSP], 5109 Leesburg Pike, Falls Church,
VA 22041-3258

SUBJECT: Status Report of the Sampling Phase of the Kuwait Oil
Well Fires Project

1. Reference Memorandum, Office of The Surgeon General, SGPS-PSP, 12 April 1991, subject: Kuwait Oil Fire Health Threat--INFORMATION MEMORANDUM.
2. Enclosed is a status report summarizing the environmental sampling portion of the Kuwait Oil Well Fires Project which was completed 2 December 1991. Data analysis is continuing as we address the health risk assessment portion of the project.
3. Questions regarding the attached should be directed to MAJ Legg at DSN 584-2024.

FOR THE COMMANDER:

Encl

Fredrick W. Boecker
FREDERICK W. BOECKER
COL, MS
Director, Environmental
Health and Engineering

CF:
Cdr, HSC

ENVIRONMENTAL CHARACTERIZATION OF THE KUWAIT OIL WELL FIRES

The U.S. Army Environmental Hygiene Agency (USAEHA), responding to a tasker from The Office of the Surgeon General, assembled a multi-disciplinary task force to determine the medical/health implications of the oil well fire smoke environment in Kuwait. The focus of the USAEHA plan was not to duplicate the work of the U.S. Interagency Air Assessment Team (USIAAT) or the U.S. Environmental Protection Agency (EPA) Gulf Task Force studies, but rather to augment their data with a concentration on U.S and Allied troop areas and the resultant potential for adverse long term health effects. The USIAAT and EPA studies had a more global/regional focus and were not intended to concentrate on troop areas. The combination of these studies will provide a more concise picture of the potential health risk in the area caused by the oil well fires.

The USAEHA plan to address the issues was to gather and/or produce, through environmental sampling and investigation, the following necessary information:

1. What contaminants were produced by the fires.
2. What are the toxicological, chemical and physical properties of the identified contaminants of concern.
3. What were the concentrations of these contaminants at troop receptor points. Over 4,000 environmental samples were collected during this engineering study to answer this question.
4. What were the major pathways and routes of exposure for the troops (i.e., inhalation of smoke and particulates; dermal contact with deposited particulates with concomitant absorption; ingestion of deposited particulates, and contaminated soil matrix).
5. Quantify and characterize the potential health risks (cancer and non-cancer) arising from exposure to the various contaminants via the defined pathways and routes of exposure with consideraton of the varying time periods of exposure.
6. Determine the clinical manifestations of exposure to the oil well fires, if any, which have been noted in country by Department of Defense (DOD) medical personnel.

ENVIRONMENTAL CHARACTERIZATION STUDY PLAN

The following is a brief description of the USAEHA study plan. Prior to initiation of any sampling or study activities, an advance team of 12 individuals proceeded the main group to ensure that all necessary logistical support was in place. In addition, the advance team performed an engineering assessment of the required sampling locations and scope of the sampling effort.

AIR SAMPLING

1. PURPOSE. As part of a multimedia environmental sampling plan, the objective of the air sampling program was to collect ambient air samples near U.S. and Allied troops and personnel to be analyzed and used as data for completing a human health risk assessment.

2. PLANNING. The initial planning phase of the ambient air sampling was accomplished during a period of approximately 4 weeks prior to deployment. During this planning effort the following tasks were completed: development of a sampling protocol, purchasing all necessary equipment and supplies, training, transport of equipment, and personal preparations for deployment to the Arabian Peninsula. The initial sampling concept reflected a need to deploy readily and to initiate sampling immediately upon arrival in Saudi Arabia and Kuwait.

The initial protocol called for a two phase approach towards the ambient air sampling. The opening phase was to consist of sampling at the following three sites for 60 days: Khobar, Saudi Arabia; Al Jubail, Saudi Arabia; and Camp Freedom, Kuwait. In addition sampling was to be conducted at the following two sites for sixty days to provide background data: King Khalid Military City, Saudi Arabia and Riyadh, Saudi Arabia. During this first phase, sampling was to be performed for the following contaminants: volatile organic compounds, total suspended particulates, particulate matter ten microns and less (PM10), metals, acid gases, ozone, nitrogen oxides, sulfur oxides and polycyclic aromatic hydrocarbons. The preceding contaminants were chosen based upon studies by other agencies, characterizations of Kuwaiti crude oil, and best engineering estimates (see Table 1). For this phase, a total of five engineers, scientists and technicians, two chemists and a senior military member were required.

A second phase of sampling was included based on a possible need for long term monitoring of what was perceived as a serious health threat. This second phase of sampling was to include real time monitoring for criteria pollutants as well as those contaminants sampled during the initial phase. Inclusion of the second phase increased personnel requirements by a minimum of five engineers, scientists and technicians.

TABLE 1: CONTAMINANTS OF CONCERN--TARGET COMPOUND LIST**Volatile Organic Compounds:**

Benzene	Toluene	m-Xylene
o-Xylene	Propyl Benzene	Ethyl Benzene
Heptane	p-Xylene	

Polycyclic Aromatic Hydrocarbons:

Acenaphthene	Acenaphthylene	Anthracene
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(e)pyrene	Chrysene	Benzo(k)fluoranthene
Benzo(g,h,i)perylene	Fluoranthene	Naphthalene
Phenanthrene	Pyrene	Methylnaphthalene
Indeno(1,2,3-cd)pyrene	Cumene	Dibenzo(a,h)anthracene
Carbazole	Dibenzofurans	1-Methylnaphthalene
2-Methylnaphthalene	Biphenyls	2-6 Dimethylnaphthalene

Acid Gases:

Sulfuric Acid	Nitric Acid	Acetic Acid
Formic Acid	Hydrochloric Acid	

Criteria Pollutant Gases:

Sulfur Dioxide	Ozone	Nitrogen Oxide
Nitrogen Dioxide		

Particulates and Metals:

Total Particulates	Particulates <10 um	Arsenic
Calcium	Cadmium	Chromium
Lead	Iron	Magnesium
Aluminum	Vanadium	Nickel
Sulfates	Nitrates	Mercury
Chlorine	Beryllium	Sodium
Zinc		

3. EXECUTION. The sampling concept was augmented in the field and expanded to a third phase. No real-time monitoring was initiated because the oil well fires were extinguished in several months rather than several years, as previously expected, see the Figure.

Phase I sampling consisted of intensive, frequent air sampling at up to 10 sites through July 1991; 5 more sites than originally planned (see Table 2). This sampling was used to fine tune the sampling methods (see Table 3), and evaluate the logistical constraints of the expanded project, while maintaining a focus on the data quality objectives. The air sampling methods employed during phase I, and throughout the field survey, are shown in Table 3.

The biological surveillance initiative created the need to obtain more air quality data during the phase II sampling period, which lasted through August 1991. Samples were collected at the same number of site (minus the one site located on the Kuwait/Iraq border) but the frequency of sampling was decreased.

Phase III of sampling was initiated to obtain background air quality data as the number of well fires diminished and continued for as long as U.S. troops remained in Kuwait. This sampling phase lasted from mid-September 1991 to early December 1991. The number of sampling locations was decreased to only three sites; two sampling sites near Kuwait City, and one site near Dhahran, Saudi Arabia.

Logistical constraints were the primary challenge encountered during the collection of air samples. Sampling sites, were isolated by several hundred kilometers from the main logistical base. Samples were consolidated by air transport twice a week for over 200 days in Saudi Arabia. Arrangements for timely transportation of air samples to the USAEHA laboratory was necessary due to short sample media holding times.

The transport, procurement, and maintenance of equipment and supplies was also key to the success of the air sampling project. Site selection was limited to locations of U.S. troop units, accessibility, security, continuous power requirements, and personnel support requirements.

FIGURE.

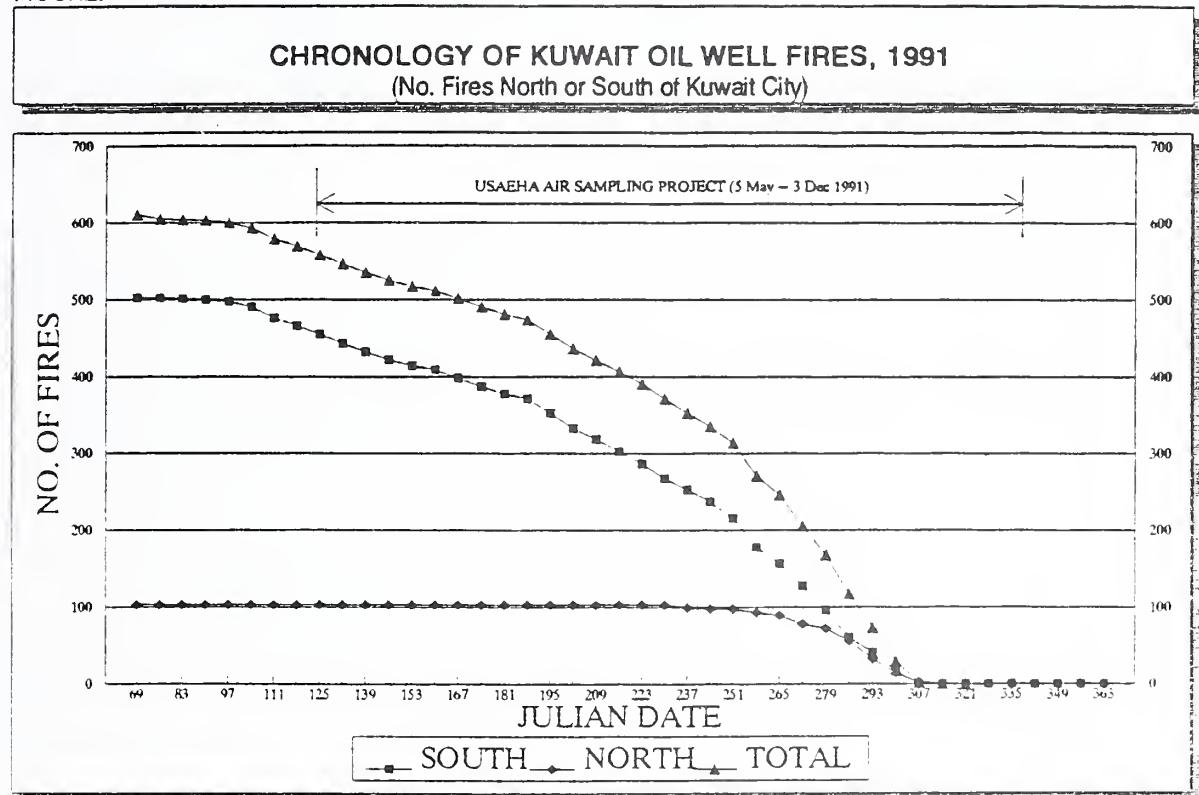


TABLE 2: SUMMARY OF PROJECT: SAMPLING LOCATIONS AND SAMPLING DURATION

SAMPLING SITE	SITE DESIGNATION	LOCATION	SAMPLING PERIOD (1991)	SAMPLING DURATION (days)
Khobar Towers	03	Khobar, S.A.	6 May - 2 Dec	210
Camp 1	05	Jubayl, S.A.	8 May - 4 Aug	88
Camp Freedom	CF	Subhan, Kuwait	11 May - 17 May	7
Armed Forces Hospital	MH	K.C., Kuwait	17 May - 2 Dec	199
U.S. Embassy	EM	K.C., Kuwait	19 May - 15 Jul	57
Camp Abdaly	CA	Abdaly, Kuwait	19 May - 5 Jun	17
KKMC	02	KKMC, S.A.	19 May - 25 Aug	98
Eskan Village	04	Eskan, S.A.	25 May - 25 Aug	92
Camp Thunderock	CT	Doha, Kuwait	6 Jun - 2 Dec	179
Ahmadi Hospital	AH	Ahmadi, Kuwait	6 Jun - 6 Jul	30

S.A. = Saudi Arabia

K.C. = Kuwait City

TABLE 3: SAMPLE COLLECTION METHODS EMPLOYED DURING THE PROJECT

CONTAMINANT CLASSIFICATION	SAMPLING METHOD	COLLECTION SUBSTRATE/MEDIA	ANALYTICAL METHOD
VOCs	EPA TO-1*	Tenax	GC/MS
PAHs	EPA TO-13*	PUF/XAD-2	GC (FID/PID)/MS
PAHs	EPA TO-13#	XAD-2	GC (FID/PID)/MS
PAHs	High-volume	Quartz/Glass Filter	GC (FID/PID)/MS
TSP	High-Volume	Quartz/Glass Filter	Gravemetric
PM10	High-Volume	Quartz/Glass Filter	Gravemetric
Metals	High-volume	Quartz/Glass Filter	AA/ICP
Acid Gases	NIOSH #7903	Silica Gel	IC
Hg	NIOSH #6009	Hydrar	CV/Hydride
SO ₂	PSD	Coated Filter	IC
O ₃	PSD	Coated Filter	IC
NO _x	PSD	Coated Filter	UV/NIR

* Low-volume method

High-volume method

GC/MS = Gas Chromatography/Mass Spectrometry

PUF = Polyurethane Foam

FID = Flame-Ionizing Detector

PID = Photo-Ionizing Detector

AA/ICP = Atomic Adsorption/Inductively Coupled Plasma furnace

IC = Ion Capture

CV = Cold Vapor

UV/NIR = Ultra Violet/Near-Infrared transmission

PSD = Passive Sampling Device

NOTE: Tenax and Hydrar are registered trademark names which are identified here to illustrate a particular method and does not imply endorsement by the USAEHA or the U.S. Army

SAMPLING OTHER ENVIRONMENTAL MEDIA

1. PURPOSE. To fully characterize the troop exposure and resulting potential health risk all operative pathways of exposure must be evaluated. To meet this need sampling of other environmental media, such as soil containing deposited particulates was carried out.
2. SAMPLING CONCEPT. Composite surface (0-2 inch depth) soil samples were collected from the same areas where air sampling was being conducted. The data generated from these samples will be used to assess the dermal and ingestion exposure pathways to deposited particulates produced from the oil well fires. The sampling was conducted by the personnel doing the air sampling and required no additional resources. In addition, observations of troop activities were conducted to determine exposure parameters and scenarios for use in the risk assessment process.

PERSONNEL REQUIREMENTS

1. A total of 30 USAEHA personnel were deployed to the Southwest Asia Theater of Operations from May 1991 to December 1991. The professional contingent included environmental engineers, environmental scientists, occupational and environmental medicine physicians, industrial hygienists, chemists, and engineering/environmental science technicians.
2. Over 50 additional personnel at the USAEHA were involved in logistical support, laboratory analysis, and ancillary technical support of the environmental characterization of the Kuwait oil well fires study.

COST ESTIMATE/ACTUAL EXPENDITURE

Listed below is the cost estimate and actual expenditure for the sampling phase of the oil well fire environmental characterization study. The categories included in these cost figures are: travel; transportation of equipment, samples, and consummables; contracts; purchase of equipment and consumable supplies; and, labor.

<u>COST ESTIMATE</u>	<u>ACTUAL EXPENDITURE</u>
1.5705 Million	1.5053 Million

CONCLUSIONS

1. Overall, measured pollutant levels in both Kuwait and Saudi Arabia were lower than previously expected and predicted by other agencies. An explanation of this phenomena can be found from the regional meteorological conditions and other environmental conditions which affected the dispersion and transport of the Kuwait oil fire plumes. The oil fire plumes remained aloft in the mid-troposphere and behaved as a stable "super plume" with limited mixing between the plume base and ground surface. In addition, the low level tropospheric wind flow patterns were affected by the thermal properties of the oil fires and the proximity to the Persian Gulf. However, the predominant northwest to southeast mid-level tropospheric wind flow pattern dominated the overall downwind plume transport.
2. The particulate matter measurements for all sites were elevated and generally exceeded the U.S. National Ambient Air Quality Standard for particulate matter less than 10 microns in diameter (PM_{10} , a 24-hour primary standard concentration equal to 250 micrograms per cubic meter). The elevated PM_{10} concentrations decreased over time and are related to the decreased frequency of the Shamal wind patterns. The Kuwait region is known to exhibit the world's highest airborne particulate concentrations.
3. No observable long-term trends of specific oil well fire pollutants were evident at downwind locations in eastern Saudi Arabia. Kuwait air monitoring sites located adjacent to the Al Ahmadi oil fields display higher volatile organic compound concentrations during June 1991 as compared to other monitoring sites for the same period of record. The polycyclic aromatic hydrocarbon (PAH) results display quantities at or near the compounds' detection limits with no measurable quantities observed for the most potent carcinogenic PAH, benzo(a)pyrene.
4. Anthropogenic air pollution sources, including the region's extensive petroleum refining industry and mobile sources, could have comprised a portion of the measured pollutant concentration levels in Kuwait and Saudi Arabia. Also, exacerbating the air pollution was the contribution of background metals contamination from the soil matrix entrained in the plumes. These additional sources of airborne contaminants serve to confound the incremental risk characterization attributed solely to the oil well fire plumes.

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JULY 1991

U.S. Studies Kuwait Fire Risks

ABERDEEN PROVING GROUND, MD.—Army medical researchers are monitoring health risks to American troops from Kuwaiti oil well fires.

Lt. Col. David Deeter, MC, USA, director of occupational and environmental health at the U.S. Army Environmental Hygiene Agency (AEHA) here, said the research team has examined troops being rotated into Kuwait. By testing troops before deployment, he said, the medical team will be able to ascertain health effects caused by exposure to pollution from the well fires.

The troops for the most part are security force personnel, he related.

"As soon as we got word that there was a virgin population who had not been exposed, but would be exposed for a specific period of time, we developed a medical surveillance program," he said. "We have just returned from Europe where we did a baseline medical surveillance for about 2,500 troops...deploying to Kuwait."

Dr. Deeter said researchers will closely monitor the effects of trace metals from the smoke. Laboratory tests, he said, have shown these pollutants cause cancer in animals.

"Before you can have a cancer-causing agent you must first have gene damage," Dr. Deeter related. "We are running two very special tests, very sensitive tests, looking specifically at gene damage in the exposed population. We are also getting baseline pulmonary function tests."

The most probable health risk is pulmonary damage, he advised.

Dr. Deeter said the harsh climate and new viruses found in Kuwait mean it will take six months to notice respiratory system changes.

"By the time they get through with their six-month exposure they should be over all the acute effects, and the only thing (that) remains would be some sort of low-level chronic damage," he said. "We don't think we are going to see any (changes), but we are doing a baseline pulmonary function test now and then we will repeat it again in six months."

The medical surveillance team, which consists of scientists from AEHA, Walter Reed Army Institute of Research, and the Centers for Disease Control, will make two trips to Kuwait.

"We are going to do some of the blood tests after the soldiers have been exposed for two months, and then once again after four months," Dr. Deeter said. "And then

Kuwait Well Fires Spur Army Study

we will have three data points that we are going to be able to see whether or not there is a dose-response relationship over time."

Dr. Deeter emphasized, however, that preliminary investigation shows a low risk to the soldiers' health. The fires, he said, are so hot that smoke rises 10,000 to 15,000 feet—decreasing the likelihood of particulates falling back to earth.

"Those particulates that are big enough to fall from the sky from 10,000 to 15,000 feet are also going to be probably too big to actually get into the lungs," he explained. "...If indeed the pollution is that high, then most of what is at ground level will be much too big to be respirable. Therefore, you don't have a good deal of exposure or a lot of this stuff getting into you."

"I would suspect that there is never going to be enough dose from any one of the metals to cause a health effect, but we are still concerned with the cumulative dose," he advised.

Maj. William Legg, deputy division chief of the waste disposal engineering division at AEHA, noted that another military environmental risk assessment team has been sent to monitor air quality in Kuwait. The team set up seven sampling sites in Kuwait and Saudi Arabia for ambient air monitoring.

"We are looking at volatiles in the ambient air, organics, acids, and metals," Maj. Legg said. "...We are actually putting filters and tubes directly on soldiers in the areas where we are sampling."

In addition, he said, the team has conducted soil sampling to determine the risk of particulates contaminating soldiers through dermal contact, inhalation and ingestion.

"And then the second phase of the soil sampling will be...looking at deposition rates, if any, in the surficial soil of particulates and organics," Maj. Legg advised.

The risk assessment team will monitor the air quality near American bases for several more months, he said, but early test results show that the environmental pollution—and health risk to U.S. soldiers—is less than expected.

"From the environmental side," Maj. Legg said, "we have not found anything at this point surprising or alarming."

Col. Deeter added that when the medical and environmental teams are finished the Army will determine whether long-term surveillance of soldiers is needed.



The Army Environmental Hygiene Agency works to determine health risks to soldiers in...

The Land of the Burning Sky

Story by Heike Hasenauer
Photos courtesy USAEHA

"APPROACHING the Kuwaiti border, the sky was ominous, as though a tornado was looming. There was a dark, dismal pall of over-hanging smoke.

"Everything was brown and gray with lakes of oil all over the ground. Street lights were on at 2:30 p.m., and I was driving with the lights on and straining to see the edge of the road," recalled Dr. (Capt.) Brian Scott upon his return from Kuwait in June.

"At 500 meters from an oil well flare near the Kuwait airport, it was a bit painful. ... The flare measured 3,000 degrees Fahrenheit at the base. Within 200 meters, you needed hearing protection," Scott continued.

"I stood at the airport and counted

40, 50, 60 flares. And the smoke was thick," he remembered.

Iraqi president Saddam Hussein attempted to destroy some 650 Kuwaiti oil wells beginning on Feb. 19, 1991. His forces successfully ignited 523 of them, the first of which was capped on March 19. On May 15, the 100th oil well fire was capped.

Since May 14, members of the U.S. Army Environmental Hygiene Agency, at Aberdeen Proving Ground, Md., to which Scott belongs, have collected vials of air and surface soil from seven sites in Kuwait and Saudi Arabia affected by the burning oil wells.

Twice a week the team, known as the Southwest Asia Health Risk Assessment Team, loads the samples onto planes bound for the agency's laboratories at Aberdeen.

In mid-June, chemist Rosemary Gaffney said, "We've evaluated about 200 air samples so far and expect to test 150 to 200 samples over the next six weeks." The samples were arriving at the lab three to four days after leaving Southwest Asia.

The measures of particular compounds in the samples — nitrogen oxide, benzene, zylene and lead — are generated on state of the art computer screens at USAEHA following lengthy laboratory "boil downs" and comprehensive computer analysis.

"We extract samples for 18 hours to remove contaminants for analyses," Gaffney said. Then, if necessary, USAEHA's own library of some 40,000 compounds can be used to pinpoint lesser-known or less prevalent contaminants.

Maj. Lester Pilcher



Heike Hasenauer



Maj. Lester Pilcher



Clockwise from above: Chemist Rosemary Gaffney displays air samples from Kuwait. • 2nd Lt. Emil Dzuray collects soil samples. • An 11th ACR soldier takes a breathing test for USAEHA physicians before he deploys to Kuwait. • Maj. Lester Pilcher checks an air sampling system near Al Ahdi.

The Surgeon General directed USAEHA to assess the long-term health effects from burning oil wells on U.S. troops and Defense Department civilians. The agency is the only organization within DOD that represents all the necessary disciplines — including environmental and occupational health engineers, scientists, physicians, toxicologists

and chemists — to do the job, said Maj. Lester Pilcher, chief of the agency's Air Pollution Engineering Division.

Pilcher is in Al Khobar, near Dhahran, Saudi Arabia, where two sampling stations are set up.

"He and his team are using the same procedures used by the Environmental Protection Agency to assess the



Capt. David Gustavson

dangers of Super Fund hazardous waste sites," said USAEHA commander Col. Ronald Bishop.

In fact, the EPA has representatives in the Persian Gulf region conducting tests to determine the immediate effects of the oil well fires, and the National Oceanographic and Atmospheric Administration, which has the lead for determining environmental effects, is studying regional and global effects of the oil well fires.

"But our study is on long-term effects on DOD troops," Pilcher emphasized. "We're sampling at sites where we had large concentrations of troops, including one site near the Iraq border where we no longer have troops, but there's a Red Crescent camp that allows us to take samples daily."

That site, at Al Abdali, the refugee camp in Kuwait, is located about seven kilometers from Iraq and four kilometers from the former location of the U.S. VII Corps during the Gulf war.

Sampling in Kuwait is sometimes difficult, Pilcher said. During one three and a half week period, one of the sampling sites had to be moved three times because members of the health risk as-

The long-term effects of Kuwait's black smoke plumes, some of which soar 7,000 feet high, clearly won't be known before summer's end and most likely not before the summer of 1992.

essment team — who hook up with U.S. troops in Kuwait — had to move when the troops moved.

In June, they were with soldiers of the 912th Mobile Army Surgical Hospital that support the 3rd Armored Division at Doha, north of Kuwait City. But they moved again later in the summer when 11th Armored Cavalry Regiment soldiers from Germany replaced a brigade-size element of the 3rd AD.

At that time, USAEHA physicians traveled to Germany to conduct medical exams and collect health questionnaires from some 2,000 11th ACR soldiers scheduled to deploy to Southwest Asia. Later, both in Kuwait and upon their return to Germany, these soldiers will receive a follow-up health assessment to detect any health changes potentially associated with the oil well fires.

Fifty of the soldiers will keep log books, noting their daily chores and any physical changes they might experience. Two-hundred and fifty will undergo blood and urine tests.

The long-term effects of Kuwait's black smoke plumes, some of which soar 7,000 feet high, clearly won't be known before summer's end and most likely not before year's end, said Lt. Col. John Yasalonis, a spokesman for the Army Surgeon General.

"Hopefully, by that time we'll be able to see 'typical' troop exposures," he added. "It's a very complicated process because we're dealing with unknowns."

Soldiers need to know that the Army is working to protect their health and at the same time avert another Agent Orange-type situation, Yasalonis said.

The Army wants to assess future health effects from oil well fire exposure. This will provide for an accurate assessment of exposure and any relationship to future health problems.

Years after the Vietnam war ended, numerous claims were brought against the U.S. government by veterans who alleged they developed cancer as a result of exposure to Agent Orange.

"But, epidemiologically, that hasn't yet been proved," Yasalonis said. "Unfortunately, nobody started following Agent Orange until years later. So, there was no way we could compile any information about who was exposed."

"Now, with the oil wells, we can reconstruct who was where and collect data to determine what the risks were and are today," he continued.

Besides the numerous air samples being taken, necessary in part because of the changing Gulf winds, soil samples are being collected at seven sites, Scott said.

The surface sand, as it's wafted into the air, could be ingested by troops when it gets onto their faces and hands or onto the food they eat.

To date, USAEHA's data and reports from other agencies, including the World Health Organization and the Department of Health and Human Services, indicates "very, very low levels" of compounds that could cause chronic illness, such as carbon monoxide poisoning or emphysema, Yasalonis said. "At the levels being found, even years of exposure should not result in chronic illness."

"As a scientist, I have trouble saying flatly that nothing will occur. ... But, to date, we have no reason to believe that short-term exposure will cause any long-term effects," he added.

Pollutants burning in the atmosphere some 5,000 to 10,000 feet up don't necessarily affect people on the ground, Yasalonis continued.

While the samples taken by members of the health assessment team continue to be evaluated, the Surgeon General's office continues to monitor medical reports, as it routinely does, of sick-call patients at all the services' medical facilities.

"None of the services have reported any increase in acute diseases or respiratory illness after the oil well fires began," he said.

"But with each sampling we do, we're getting closer to the truth," Bishop said. □

Keeping the Army Clean and Soldiers Safe

Story by Heike Hasenauer
Photos courtesy USAEHA

MANY recent polls show that increasing numbers of Americans describe themselves as health- and environment-conscious. People are showing a greater interest in the value of healthy foods, exercise and the elimination of environmental health problems such as smoking and other forms of air pollution.

In neat little communities from Maine to California, concerned Americans are recycling paper, glass, aluminum and plastic. They're binding magazines and newspapers, and they're carefully separating from their garbage the empty containers and bottles that once simply added to the tonnage of waste deposited annually at disposal sites across the nation.

Also, agencies like the U.S. Army Environmental Hygiene Agency are making people increasingly aware of the harmful effects of pollution and of ways to live healthier lives.

A subordinate organization of the Health Services Command in San Antonio, Texas, USAEHA is responsible for recognizing potential health hazards, evaluating them and making recommendations to correct them.

Since 1942, when USAEHA was formed at Johns Hopkins University in Baltimore, Md., its focus has been on environmental health, readiness and life cycle management, said Col. Ronald Bishop, the agency's commander.

"What we do during peacetime is what we do during wartime," Bishop said. "In our routine missions, we train for war."

USAEHA soldiers and civilians are currently:

- Testing the soil for contamination at the Defense Department's chemical demilitarization site on Johnson Atoll in the Pacific.
- Assessing the health risk to U.S. soldiers from the oil fires in Kuwait. [See preceding story.]

- Ensuring that the destruction of Pershing II missiles at Pueblo, Colo., does not pollute the area's soil or ground water.

- Determining the properties of petrochemicals used in future armored vehicles to identify future potential health risks.

- Making certain the Patriot missile system's radar doesn't pan out over soldiers and support crews in the field during operation.

- Monitoring the Howitzer Improvement Program. Psychologists have studied lower noise frequencies called "blast over pressure" that can affect internal organs.

- Analyzing drinking water on military posts worldwide, USAEHA checks fluoride levels because too much is as dangerous as too little.

- Determining the potential connection between power lines and cancer and what's fact and fiction when it comes to radiation emitted from VCRs and microwave ovens.

- Training new equipment users. As the Surgeon General's representative for occupational health, USAEHA representatives work with program managers to establish training scenarios and requirements to ensure that soldiers are

not put at risk. This includes everything from the recently-fielded lightweight chemical protective overgarment to the M-93 Fox nuclear, biological and chemical reconnaissance vehicle used in the Middle East to detect and analyze NBC contaminants.

In Southwest Asia, some of USAEHA's 435 civilians and 165 soldiers were involved in:

- Determining the effects of excessive exposure to the sun, where the potential for absorption by American soldiers was 115 percent — 15 percent reflected from the sand.

- Assessing hearing loss from weapon systems in training and combat.

- Studying the potential health risks associated with handling equipment and munitions made from depleted uranium.

- Disseminating information on the potential for water treatment plant contamination by terrorists.

- Analyzing the water furnished by reverse osmosis systems.

- Collecting cockroaches and other insects to determine their resistance to current Army pesticides. Soldiers of the 714th Medical Detachment, part of the 44th Medical Brigade from Fort Bragg, N.C., trapped an estimated 250,000 flies in three days in Saudi Arabia, according to USAEHA's Brian Zeichner.

As DOD's lead agency for Lyme disease, USAEHA scientists collect ticks and information about the prevalence of Lyme disease on military installations. Their mission is to prevent Lyme disease throughout DOD through improved disease surveillance, educational programs and control strategies.

A portion of USAEHA's \$32.5 million budget this year is also used by biologists to screen compounds that could be potentially harmful to pregnant soldiers. The compounds include wood preservative, iodine used in water purification tablets and the ingredient in Army field sanitation solutions, according to biologist Rich Angerhofer.

"We monitor pharmaceutical waste



USAEHA workers ensure the safe disposal of hazardous wastes.



Clockwise from left: A USAEHA soldier records helicopter noise levels that could affect soldiers' hearing. • Troops in the field can credit USAEHA with their safe drinking water. • A team tests soil and checks ground water levels.



disposal practices and provide medical waste disposal information to all military medical facilities," Bishop said. Currently USAEHA reps are advising redeploying units from Southwest Asia on how to properly dispose of cleaning solvents and expired medical supplies.

An agency audiologist, a member of a military task force, recently returned from Saudi Arabia where, using 10 military occupational health vehicles, each housing a six-man audiometric test booth, they tested nearly 30,000 troops for hearing impairment. Audiologist Maj. Brian Hill was among the group deployed in April to begin testing soldiers scheduled to return to their bases in Europe and the United States.

"I was at King Khalid Military City with the 251st, 350th and 114th Medical Evacuation Hospitals to test the largest group of soldiers, chiefly Reservists and National Guardsmen who the Defense Department wanted to quickly redeploy home," Hill said.

Performing the reserve component soldiers' hearing tests in-country saved money and time, Hill said. He estimated that each audiologist put in 22 "man-weeks" in 56 days, saving a total of over 50 weeks' work.

"It was the largest hearing test ever conducted after a war," Hill said.

"We're concerned with documenting hearing loss to learn about soldiers' exposure to equipment and what hearing protection they wore," he said. "As of May 20, following some 25,700

tests, 3,900 were abnormal. About 1,400 of those soldiers require rehabilitation or hearing aids."

USAEHA's figures indicate that in 1975, 23 percent of soldiers tested — many of whom were Vietnam veterans — suffered hearing loss that warranted profiles. In 1989, the figure fell to 8.5 percent, following tests at Fort Lewis, Wash., of soldiers in the 9th Infantry Division, a unit that represents all the Army's military occupational specialties.

The recent hearing tests in Saudi Arabia, however, indicate a 13.4 percent hearing loss among Desert Shield and Desert Storm veterans, Hill said.

But the results may be influenced

by such other factors as the fact that Reservists and National Guardsmen are generally older than their active Army counterparts. So, they've been exposed to noise longer, and they could be carrying over hearing loss from their Vietnam war days or civilian job exposure, Hill explained.

Hill said: "This was the war of the portable cassette player. Everywhere I went in Saudi Arabia, soldiers were using them. In order to overcome the intense background noises of trucks, tracks, tanks and generators, they were likely turning up the volume of their radios to potentially dangerous levels."

What's harmful and what's not? That's the bottom line for soldiers and civilians at USAEHA. Everything they do is an attempt to make life better and safer for soldiers, their families and their communities. □

HSC Mercury



Vol. 18 No. 12

U.S. Army Health Services Command — Fort Sam Houston, Texas

September 1991



Heavy plumes of smoke rise from burning oil wells in the desert of Kuwait. (photo by AEHA)

AEHA team monitors danger from Kuwaiti oil-fire smoke

by Evelyn B. Riley

Heat, flames, smoke, oil-soaked landscape, unexploded ordnance, and gusts of wind carrying a heavy load of sand describes the typical work environment in the oil fields south of Kuwait City. The Iraqi destruction of the oil-rich fields in Kuwait has created a unique challenge to quickly and safely regain control of the pressurized oil wells. This requires clearing areas of dangerous explosives, building access roads, extinguishing the flames, and capping the wells.

A team of experts from the Army Environmental Hygiene Agency is in Kuwait and Saudi Arabia to evaluate health risks to U.S. personnel from the hundreds of oil-well fires. The AEHA team consists of a physician, physical scientist, industrial hygienist, chemist, air-pollution engineers, equipment technicians and health-risk personnel.

The team has set up air monitoring locations throughout Kuwait and Saudi Arabia and will provide environmental data to the Department of Defense's health-risk-assessment working group.

Fires and smoke

"Nothing I have ever seen comes close to the visual image of the fires and the smoke," Dr. Jack Heller, an environmental scientist and team chief of the AEHA Kuwait study, said. "The newspapers and TV do them no justice. It is not even explainable. It is unbelievable. The Administrator, Environmental Protection Agency, described it correctly when he said 'If hell had an amusement park this would be it.' One could sell tickets to the place, it is that spectacular."

A cohort of about 2,000 soldiers will deploy to Kuwait for six months as part of the peace-keeping force. Identification of these soldiers before exposure to the smoke provides a rare opportunity for meaningful medical surveillance and biological monitoring. Documenting their health before and after

deployment will give information related to dose and possible exposure-related health and physiologic effects.

Soldiers will fill out questionnaires and be given medical tests before deployment, at 45-60 day intervals twice during deployment, and after returning to the U.S.

Rare opportunity

"The medical surveillance that the USAEHA is conducting is especially notable. This may be a unique achievement in environmental and occupational medicine and health. It is a rare opportunity to practice true medical surveillance with respect to exposure to environmental contamination, and to medically follow the subjects throughout the ordeal. The exercise of this opportunity accomplished by the USAEHA through their immediate matrixed response is truly singular. Following such a group with sensitive markers of exposure is even more remarkable," said CPT Brian G. Scott, an occupational medicine officer who is assisting with the medical surveillance plan.

"The difficulty with conducting this survey was that there was no single point of contact," said LTC George Murnyak, who was in charge of the industrial hygiene sampling. "We had to develop that in each area."

An ordnance unit in the Saudi desert, military and unit police guard posts, and military port operations are examples of work places that were sampled at installations in both countries. The soldiers were cooperative and willing to help."

The survey provided the chance to experience a different culture, be part of a large military operation, and evaluate a unique environment. Data was collected in Saudi Arabia until the end of August. Data will be collected in Kuwait as appropriate which may mean as long as troops are deployed. (AEHA)

Kuwaiti Oil Fires: Dangerous to DoD Personnel's Health?

NOVEMBER 18, 1991

By Evelyn D. Harris
American Forces Information Service

Americans watching televised coverage of Kuwaiti oil well fires saw blackened skies, ashes falling like black snow and distraught Kuwaiti parents telling of their fears for their children growing up in the shadow of that hell.

Experts agree this is a terrible environmental tragedy for the Middle East.

But is there an effect of the smoke on the health of U.S. soldiers, sailors, airmen, Marines and DoD civilians? Shortly after the Iraqis set more than 600 Kuwaiti oil wells on fire in February, Dr. Enrique Mendez, assistant secretary of defense for health affairs, created a task force to begin answering that question. The tri-service group will continue its work until the answer is found, said Navy Dr. (CDR) Kenneth St. Andre, a senior policy analyst in Mendez's office.

"There are acute hazards to people while they are on site — coughing, eye irritation, even a greater risk of vehicle accidents due to reduced visibility caused by the smoke," St. Andre said. "Our people have protective gear and clothing and have been advised on how to minimize such dangers."

"But there is some good news," he added. "So far, the data we've received indicate that levels of pollutants in the air are much lower than we expected. It looks like there may be no long-term negative health effects on DoD personnel. Of course, the studies are not completed."

Army Dr. (Col.) Richard Erdtman heads the tri-service group, which is trying to determine what troops were exposed to, in what quantities and what future risk they may face from such exposure.

Since May, a team from the U.S. Army Environmental Health Agency has been sampling air, soil and personal breathing zones at all former major fixed troop locations and at selected sites in Kuwait and Saudi Arabia. The team had more than 3,000 samples by the end of September. Testing will continue until at least one month after the fires are extinguished. The group will use these as the basis for assessing health effects of the smoke.

Researchers are looking for short-term, mid-term and long-term health risks.

Carbon monoxide and hydrogen sulfide are two poisonous gases that can cause short-term problems and quick death. Samples tested so far indicate levels of these pollutants are at safe levels. Experts said this could be because the fires are burning so hot there is complete combustion of these byproducts.

Mid-term health risks could be posed by lead poisoning and hydrocarbon toxicity. So far, military medical care providers have not seen cases of such poisoning in personnel in the Persian Gulf region. Also, air samples show low levels of such toxins.

Possible long-term health effects include lung cancer and leukemia. Since these diseases take years to develop, it is extremely difficult to form a firm scientific conclusion, said St. Andre. Other factors — health habits and genetics — complicate any assessment. However, St. Andre said so far the data indicate military personnel and DoD civilians will not be exposed to the pollutants long enough to develop such diseases from their Persian Gulf experience.

The Navy surveyed some 2,700 Marines stationed in Kuwait during Desert Storm to determine if they, being closer to the fires, had higher sick-call rates than military personnel not exposed to the smoke. Although the Marines did not appear to have higher sick-call rates, they reported more respiratory problems on self-report questionnaires than did personnel not exposed to the smoke from the fires.

Before the 11th Armored Cavalry Regiment deployed to Kuwait in June 1991, Army medical personnel gave troops health-status questionnaires, pulmonary-function tests and blood tests. The Armed Forces Institute of Pathology, Johns Hopkins University Medical Center and the Public Health Service's Centers for Disease Control will assist in analyzing those test results and follow-ups done in Kuwait and upon the regiment's return to Germany.

There are also plans for long-term surveys, and the Department of Veterans Affairs is involved and prepared to take action should later treatment be necessary, said St. Andre. 

Transcription of the Army Information Radio Service regarding Kuwait

The Army Information Radio Service News Feed for Tuesday the 12th of November until Wednesday the 13th, 3:00 p.m. Eastern Time. Today we have 4 stories for you on the following subjects:

Cut Number 1, SPC Chris Bentley: Environmental Risk of Kuwaiti Oil Well Fires, run time 1 minute 15 seconds.

As Desert Storm forces drove Iraqis from Kuwait, over 700 burning oil wells were left behind. Last week, the final fire was extinguished. The Army is concerned about the effects of exposure to the contaminated atmosphere on its soldiers. CPT Brian Scott is a physician and a specialist in occupational and environmental medicine "What this Agency, the Army Environmental Hygiene Agency, is involved with is assessing the risk of adverse long-term health effects to DOD troops in the Persian Gulf which might be due to the burning oil fires."

The movement of large numbers of troops into the Persian Gulf presented the opportunity to construct a computer model. The Agency has already measured the concentrations of contaminants in the Kuwaiti air and soil, and they know how long soldiers were exposed. Those numbers are fed into a computer, and the probability of soldiers contracting a disease is calculated. LTC David Deeter is of the Directorate of Occupational and Environmental Health, "If indeed there is risk associated with being exposed to the oil fire smoke, as soon as that risk can be determined it is our responsibility working through DOD to let the soldiers know what that risk is."

The Environmental Hygiene Agency expects to report its findings by the fall of 1992. SPC Chris Bentley, Washington.



NEWS RELEASE
PUBLIC AFFAIRS OFFICE

U. S. ARMY ENVIRONMENTAL HYGIENE AGENCY
ABERDEEN PROVING GROUND, MD 21010-5422



FOR MORE INFORMATION CALL (410) 671-2088/2557 FAX# (410) 671-2084

28 January 1992
92-03

ENVIRONMENTAL CHARACTERIZATION OF THE
KUWAIT OIL WELL FIRES

By: Evelyn B. Riley

The deliberate destruction of more than 700 oil wells in Kuwait during the Persian Gulf War, including setting afire more than 600 wells, created an unprecedented manmade environmental catastrophe. It was determined early in 1991 that the smoke from Kuwait's burning oil wells posed an undefined, potential, long-term health threat to our soldiers. The Office of the Secretary of Defense established an expert working group headed by the U.S. Army Surgeon General's Office. Efforts were focused on determining potential chronic health impacts upon military and civilian personnel exposed to oil fire contaminants. Accordingly, the U.S. Army Environmental Hygiene Agency located at Aberdeen Proving Ground, Maryland, conducted a comprehensive environmental health characterization in Kuwait and Saudi Arabia.

A uniquely, matrixed organization with both environmental and medical expertise, USAEHA was tasked with the collection and *Nationally Recognized as the Center of Matrixed Occupational and Environmental Health Excellence*

assessment of data related to the long-term health effects upon Allied Forces in Kuwait due to the oil well fires. A comprehensive field sampling investigation was accomplished from May through December 1991. Lieutenant Colonel Wendell C. King, P.E., was the on-site project leader from June through August and was a major contributor to the execution of the ambient air sampling program.

Approximately 4,000 air and soil samples were collected at 10 locations in Kuwait and Saudi Arabia. Oil-fire related contaminants and background substances encompassing respirable particulates, metals, volatile organic compounds, acid gases, ozone, and polycyclic aromatic hydrocarbons were analyzed by USAEHA laboratories. Corresponding soil analyses included metals and semivolatile compounds.

This environmental health engineering study represents a comprehensive air pathway analysis which characterizes human exposure from a major, regional environmental contamination source.

This dynamic team effort involved many areas of environmental engineering practices, all available at USAEHA. Results of this extensive sampling effort will be used to generate an in-depth health risk assessment within the coming year.

MAJ Lester Y. Pilcher

Contributions to the USAEHA Air Pollution Sampling of the Kuwaiti Oil Fires

My responsibilities and contributions consisted of developing the air pollution sampling strategy and plan, determining the sampling parameters and sampling frequency, selecting and setting up the sampling sites, and supervising the air pollution sampling performed in Kuwait and Saudi Arabia.

Prior to going to Saudi Arabia and Kuwait, I did the following:

- Contacted EPA personnel, including those who were in Saudi Arabia doing air pollution sampling, to assess the situation and obtain analytical results to use as a basis for developing a sampling plan.
- Developed a flexible sampling plan to obtain the data required to perform a health risk assessment. My sampling plan included a novel sampling procedure, passive dosimetry, that had only recently been verified by EPA as being suitable for air pollution sampling. My plan had four sampling sites as requested by OTSG and I provided for one other contingency site plus backup equipment. I modified the plan while in country and had as many as eight sampling sites running at one time which was twice the number we were originally requested to set up.
- I arranged for the EPA person who had been in Saudi Arabia and Kuwait doing the screening sampling to come to USAEHA to brief me and consult on the situation and possible air emissions from the oil fires. I also had an EPA laboratory person who was familiar with the passive dosimetry sampling and analytical procedures come to USAEHA and train DLS and sampling team personnel in the sampling and analytical procedures.
- I presented the sampling plan at a meeting of the EPA Interagency Task Force and to personnel from the SGO.
- I arranged for EPA and NOAA to get their equipment shipped to Saudi Arabia in an expeditious manner. At the briefing in Saudi Arabia for the Presidential Fact Finding Team which included the Administrator of EPA, Mr. Riley, and the Technical Director of NOAA, my role in getting their equipment to Saudi Arabia was brought to the attention of Mr. Riley who personally thanked me.
- I coordinated the lab support we would need and coordinated with the health risk assessment personnel to ensure that the sampling plan was consistent with data that was needed for a health risk assessment.
- I determined the types and amounts of sampling media we would need for the survey. When the survey was extended from the original four sampling sites to eight and from 60 days to an extended period of time, I determined the additional sampling media needed and coordinated this with APED personnel who were ordering the equipment.
- Made contact with the EPA head of the EPA Intergovernmental Task Force and arranged for USAEHA to participate in meetings of the task force and on the subcommittees for Health Issues and Modeling.
- I coordinated with the Air Force, the Navy, and EPA to borrow enough sampling equipment to perform the survey. Only EPA had equipment and I obtained the loan of enough equipment to support the USAEHA survey so that we would not have a delay due to procuring the equipment. In addition, I arranged for APED personnel to go to RTP, NC and pick up the equipment.
- I planned a training session that was taught by APED personnel to train members of the sampling team to operate the air pollution sampling equipment.

While in Saudi Arabia and Kuwait, I did the following:

- I selected all sampling locations and assisted the project officer with setting up the sampling site, except for KKMC which I inspected after it was set up to verify that it was a suitable sampling location.
- I supervised and coordinated all sampling done during the first two and one half months of the survey. This included modifying the sampling plan on a frequent basis due to availability of sampling media and estimate of when additional sampling media would be available.
- I made periodic trips to the sampling sites, including four trips to Kuwait, to bring supplies, personnel, and equipment and to evaluate and supervise the sampling effort.
- I coordinated in-country support with local Preventive Medicine personnel.

- I maintained liaison and briefed U.S. EPA and NOAA personnel in country, Saudi Arabian EPA personnel, Kuwaiti Ministry of Health Personnel, the CENTCOM CG staff, the CENTCOM Surgeon and his staff, and U.S. COE personnel in Kuwait.
- Contacted and obtained permission from the International Red Cross/Crescent personnel to set up a sampling site at a refugee camp near the Iraqi border.
- I coordinated with DLS personnel to determine the adequacy of our sampling rates for organics and determined modifications as required.
- Briefed the Presidential Fact Finding Team consisting of the Administrator for EPA and the Technical Director for NOAA.
- At a critical point in the sampling, I obtained sampling media in country from EPA so that our sampling effort could continue without long intervals between sampling periods and loss of critical data.

TRIP REPORT

Site Visited: Al Kobar and Al Jubail, Saudi Arabia

Date: 16 May - 10 July 1991

Purpose: To conduct onsite surveys of environmental samples.

Traveler: Nathan Sher, Laboratory Worker, Organic Environmental Chemistry Division

Summary of Visit:

It was thought that since I am in the Maryland Air National Guard that I could be utilized quicker than the average "civilian." My unit was to be deployed to Saudi Arabia in January, but we were not needed due to the one-sided allied victory over Iraq. Since I am a C-130E Hercules Loadmaster, I had my passport, all of the necessary clearances, and a Saudi Arabian visa to start my journey.

I was told to be in front of Building E2100 at 0745 to leave for the Philadelphia Airport. I arrived at 0700 on 15 May, bags in hand, ready to start my adventure. At 0843, we were on our way to Philadelphia. I made the journey in country with CPT Weaver. We left Philadelphia around 1400 local, and, after a brief stop in Ireland for fuel, we arrived at our destination around 1730 local.

My first day consisted of learning how the "locals" and civilians drove and who my new roommates were. I liked my roommates a whole lot better than the crazed drivers of Saudi Arabia.

A conclusion that was soberingly apparent upon my arrival in country was the heat and the incredible sand storms. You wouldn't know or believe it unless you were there. It wasn't anything you can explain. You just had to live it to really know.

The first task I was given was to be responsible for sample media collection. Our sites included: Ryhad, KKMC, Al Kobar, Al Jubail, and all four sites located in Kuwait. Driving was ruled out because some sites were so remote, which made collection by aircraft the only feasible alternative. This in itself was a nightmare of an operation to undertake. I found that I basically had two options available. One was flying on an Air Force C-130 or an Army C-12 aircraft. Both aircrafts were on a space available basis, and their flight plans did not always coincide with where I needed to be and when I was required to be there. Luckily the C-12 unit took over its own scheduling and put together a courier flight on Tuesdays and Fridays. It was still on "space A" status, but more reliable than any other option. There were also problems with communication between sites. When I got on a flight, there was normally no way to inform the site.

I had a variety of responsibilities that were assigned to me during my stay. I would collect the samples from all the sites and prepare them for the cooler. The cooler had dry ice in it, which we picked up Mondays, Wednesdays, and Saturdays from a local supplier. I was required to take the cooler of dry ice to the aircraft and also wait to receive it on the flight's return. On the first few flights, I accompanied the cooler, but when space became limited, only the cooler went aboard. The flights would bring to the sites all the supplies, mail, and sample media. The sites would send their samples back for shipment to USAEHA. I was involved with the loading and unloading of the flights. I was also entrusted with the inventory, the chain-of-custody, preparing samples for shipping, and shipping of all sample media.

Another responsibility was conducting the actual sampling of ambient air with 1LT David B. Martin at the Al Kobar and Al Jubail sites. The Al Kobar site was located on the roof of our building. Our site at Al Jubail consisted of the same sample media and a Baskin Robbins 31 Flavors ice cream trailer. Al Jubail was about an hour and a half drive one way. It was called Camp One by the Army that used it. The drive would have been hell if it were not for the ice cream trailer.

Mr. Daniel Noble, 1LT David B. Martin, 1LT Emil J. Dzuray, 1LT Brian W. Higgins, MAJ Lester Y. Pilcher and I left Al Kobar on 10 July 1991. Our plane left Dhaharan Airbase at 2100 for our journey home. However, I just couldn't shake the feeling that the plane would land and we would get off and still be in Saudi Arabia. It would be some sort of cruel joke. Fortunately, it was not. When the doors did open, after a fuel stop in Italy, we were home. I rented a car and drove back to USAEHA with Dan Noble. The first thing that we noticed, other than the fact that the girls weren't dressed like Darth Vader, was how green everything was. Traveling around can really make you appreciate what you have at home.

Conclusion and Recommendation:

As a proposal for future travellers, I would like to suggest that pre-travel briefings include discussions on how per diem, etc., will be handled. A shortage of information concerning these matters made it infeasible for the traveller to make informed decisions. Such future briefings might include the following: type of work involved, quarters available, travelling arrangements, number of meals allotted per day and are those meals provided or not. Despite all things encountered, I thank God that I live in the United States of America. My experience in Southwest Asia was something I shall never forget. My experiences, both good and bad, will stay with me for a long, long time.



In the final days of the Persian Gulf War, the setting afire of over 600 oil wells posed innumerable environmental and engineering challenges. Even the combustion products of adjacent oil wells could be quite different. The white plumed fires, indicative of oil wells impacted by salt-water intrusion, burned cooler but with more products of incomplete combustion than its black-plumed neighbor.



Over 4,000 air and soil samples were collected at 10 locations in Kuwait and Saudi Arabia. Oil-fire related contaminants including total suspended and respirable particulates, metals, volatile organic compounds, acid gases, ozone, and polycyclic aromatic hydrocarbons were analyzed by the Army Environmental Hygiene Agency laboratory.



While the catastrophic impact of the $600\pm$ oil well fires posed unique environmental consequences, it was difficult to differentiate their contribution from the pollutant load attributable to the constantly blowing sand or from the numerous large refineries. The Shell-Petromin is the largest refinery in the world with over a 250,000 barrel per day intake.



The logistical problems associated with setting up a sampling network halfway around world were formidable. The maintenance of fresh reagents, the collection of samples from locations spread out over Kuwait and Saudi Arabia, and the transport of these samples back to the laboratory at Aberdeen Proving Ground, Maryland, took extraordinary coordination. The long hours and irregular schedule of the chemists were a vital key in the success of this project.

Desert Health Physics

By: Evelyn B. Riley

CPT Mark Bower and SFC Scott Goodison of the Health Physics Division were alerted three times to go to Kuwait -- the third time they actually got on the plane. They were excited and saw it as an opportunity to conduct health physics in a desert field environment, a rare experience for AEHA.

CPT Bower, a nuclear medical science officer, and SFC Goodison, a health physics technician, visited Dhahran, King Khalid Military City, and Camp Doha (Kuwait City) from September 23 to October 4. They established a dosimetry program, evaluated potential hazards from x-ray machines, provided a site plan for downsizing an evacuation hospital, and evaluated radiation hazards on captured Iraqi equipment.

"The radiology personnel at the 21st Evaluation Hospital and the 122nd Medical Detachment had no onsite health physics support," explained CPT Bower. "We were able to provide recommendations and make changes to reduce the risk of potential radiation exposure."

"After Desert Storm, the Industrial Health Physics Branch answered many telephone inquiries with respect to the potential radiation hazards associated with captured Iraqi equipment returned stateside," added SFC Goodison. "While in Southwest Asia we saw this as an opportunity to be proactive and provide training onsite."



CPT Mark Bower, Health Physics Division, measures leakage radiation from a field dental x-ray machine



SFC Scott Goodison, Health Physics Division, evaluates potential radiation hazards associated with an Iraqi antiaircraft gun which will be sent to a United States museum

Sand for Schwarzkopf ...

a dirty story!

By: Evelyn B. Riley

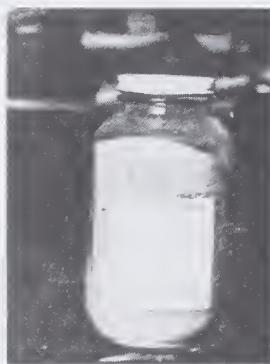
The opportunity of a lifetime came recently for soils scientist Keith Hoddinott. How many people get to do a favor for a national hero, General Norman H. Schwarzkopf? Here are the facts.

Paul Harvey, prominent radio commentator, mentioned that the General had collected soil from the liberated beaches of Kuwait which he wanted to keep as a souvenir of the Gulf War. However, the U.S. Department of Agriculture would not let him bring the soil into the United States. Keith manages the Soil Permit for AEHA and he knew how to do it! He decided to help the General. Now here, folks, is where good liaison and excellent working relations with different government departments pay off.

He discussed it with the USDA, keeping it on a technical level. A variance was needed from the usual procedure (test, treat and bury) to keep the soil in storage (but not in our laboratory). Based on our past record of handling soil, and since it was not a recurring request, permission was granted. Then they asked the question - Who is it for? When Keith told them, USDA said "Oh, that soil." They had even less apprehension then, as they knew it would stay in a jar on a shelf.

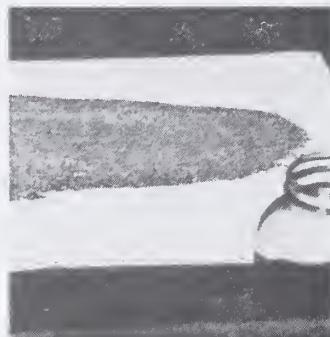
Hats off to Keith who took the initiative to go a little beyond his call of duty. He has been with the Waste Disposal Engineering Division for ten years and has handled a lot of dirt!

Keith demonstrates the procedure in the following photos, taken by Ben Bunger.



1. Soil received from Saudi Arabia

4. Removed from oven



2. Soil inspected for foreign objects

5. Cooling time



3. Into the oven for dry heat sterilization (USDA requires 16 hours at 400 degrees Fahrenheit)

6. Preparing for shipment to CENTCOM, Florida



The display panel for our study, Environmental Characterization of the Kuwait Oil Well Fires.

Official Entry Form

1992

Excellence in Environmental Engineering

Please complete and furnish the information requested below with each entry. Entrant, project and owner names should be typed or printed as they are to appear on the award.* Addresses, if a Post Office Box, should also include a street address.

Award Category (check one)

Research University Research
 Planning Small Project
 Design Operations/Management

*Entrant's Name(s) U.S. Army Environmental Hygiene Agency

Name of Engineer in Responsible Charge LTC Wendell C. King, P.E. Licensed in MN State License No. 0144733

Address Dept. of Geography and Environmental Engineering, U.S. Military Academy West Point

City West Point State NY Zip 10996-1695

*Name of Project Environmental Characterization of the Kuwait Oil Well Fires

Address Commander, U.S. Army Environmental Hygiene Agency, Bldg. E-2100

City Aberdeen Proving Ground State MD Zip 21010-5422

*Owner's Name and/or Client's (if applicable) COL Frederick J. Erdtmann

Address Office of The Surgeon General, U.S. Army Health Professional Support Agency

City Falls Church State VA Zip 22041-3258

Names and locations of other consultants or participants None

Where applicable, please complete the following.

estimated project cost \$1.57 Million actual project cost \$1.51 Million

scheduled date of completion December 1991 actual date of completion December 1991

Person to contact regarding entry Stephen L. Kistner, P.E., DEE

Address USAEHA, ATTN: HSHB-ZA, APG, MD 21010-5422 Phone (410) 671-2565



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SOLID WASTE ASSOCIATION OF NORTH AMERICA
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
WATER POLLUTION CONTROL FEDERATION

APPENDIX G

DOCUMENTATION



DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY HEALTH SERVICES COMMAND
FORT SAM HOUSTON, TEXAS 78234-6000



REPLY TO
ATTENTION OF:

25 APR 1991

HSTR (870)

MEMORANDUM FOR Commanders, HSC Activities

SUBJECT: Operation Desert Shield/Storm (ODS) Historical Documentation

1. You are to take immediate action to identify, retrieve, and preserve all significant documentation relating to Operation Desert Shield/Storm (ODS).
2. The relevant documentation includes (but is not limited to) initial and subsequent tasking correspondence, records of related meetings, briefing papers and notes, information papers, working papers, minutes or notes of action officers' meetings, administrative papers which influenced the command's ability to perform its mission, and all relevant message traffic. Personal correspondence and/or journals generated by U.S. Army Health Services Command (HSC) personnel engaged in any aspect of ODS also constitute valuable primary historical documents for preservation with their owners' consent. A catalog of each office's holdings is an important first step toward organizing this information. We suggest that you provide that direction to your elements.
3. The Analysis and Technical Support Division, Directorate of Evaluation and Standardization (DOES), Academy of Health Sciences, U.S. Army (AHS) is charged with the final assembling and preservation of these documents by working in conjunction with the AHS/HSC Historian. The DOES will provide specific coordinating instructions via this headquarters to all elements of HSC for the identification and transfer of this documentation to DOES.
4. Our point of contact is SFC Hineman, DOES, AHS, DSN 471-8171.

FOR THE COMMANDER:

JOHNNY L. CONNER
Colonel, MS
Chief of Staff



REPLY TO
ATTENTION OF

SGPS-PSP

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
5109 LEESBURG PIKE
FALLS CHURCH, VA 22041-3258



12 April 1991

MEMORANDUM FOR CHIEF OF STAFF, ARMY

SUBJECT: Kuwait Oil Fire Health Threat--INFORMATION MEMORANDUM

1. Purpose: To provide information concerning action to define potential health risks from Kuwaiti oil fires.

2. Discussion:

a. Smoke from Kuwait's burning oil wells poses an undefined potential long term health threat to our soldiers. Although we believe virtually all soldiers have a low risk of sustaining any significant effect, Congress, the media and the U.S. public have already compared this situation to "Agent Orange".

b. The ARCENT Surgeon issued a health advisory in early March giving practical protection advice against acute health effects. Informal contacts with ARCENT physicians indicates no increase in medical facility visits for acute respiratory complaints.

c. Unfortunately, the uncertainty caused by the limited exposure data available does allow claims of much greater potential risk than we believe actually exists. Potential risks are for the very small number of soldiers who may have continuous or long term, high level exposure to specific types and size smoke particles. Those risks include a slight increase, over a lifetime, in expected cancers, chronic respiratory irritation and increased susceptibility to respiratory illness.

d. The U.S. Environmental Protection Agency sampled the oil fire smoke in mid March. Their "snap shot" sampling confirmed little acute risk. They chose not to assess long term risk from exposure to the very dynamic and variable smoke plumes based on the few samples they collected from a limited geographic area. Although they plan additional sampling they are not focused on our troop locations and do not have a specific timetable or the resourcing to accomplish their sampling plan.

e. We have a multi-disciplinary team of Army health experts at the U.S. Army Environmental Hygiene Agency (USAEHA) with the capability to assist the CENTCOM CINC characterize potential exposures and perform a health risk assessment. Due to the large geographic scale, meteorological variability and complicated nature of the dose-response relationships it will take the full team several months to characterize exposures.

SGPS-PSP

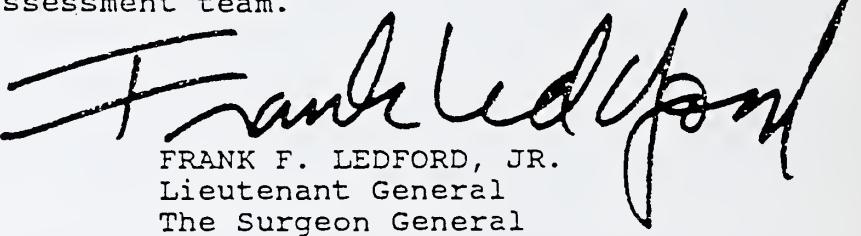
SUBJECT: Kuwait Oil Fire Health Threat--INFORMATION MEMORANDUM

f. The Deputy Assistant Secretary of Defense (Environment) has signed a Memorandum (TAB A) requesting that JCS ask CENTCOM to assess acute and long term health risks to our soldiers. It also asks JCS and CENTCOM concurrence to deploy and support the USAEHA team to accomplish the assessment.

g. CENTCOM will have to dedicate some resources for shelter, rations, transportation, electrical power, security and other logistical support critical for the most effective operation of the team. However, it is imperative Army adequately evaluates the long term health risks of our soldiers from oil fire smoke. If exposures are negligible we will not require an extremely costly epidemiological study similar to those done for "Agent Orange". However, if the AEHA team's data does predict significant long term health effects, then there is scientific basis to begin prospective epidemiological studies of our soldiers using current records.

h. Accordingly, we are taking actions to arrange deployment of the USAEHA health risk assessment team.

Encl


FRANK F. LEDFORD, JR.
Lieutenant General
The Surgeon General

CF:
DACS-ZB
DAMO-ZA
DAPE-ZA
DAPE-HR



THE OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301-8000

APR 11 1991

PRODUCTION AND
LOGISTICS

MEMORANDUM FOR DIRECTOR, JOINT STAFF

SUBJECT: Environmental Health Monitoring and Risk Assessments
- Kuwait Oil Fire Smoke

This is to request JCS assistance in asking CENTCOM to collect environmental health data for use in: (1) assessing the acute health risks to DoD personnel exposed to the smoke from the Kuwait oil fires, and (2) evaluating the potential long-term health risk to our personnel.

The Environmental Protection Agency (EPA) is leading an interagency working group to determine both short and long-term hazards to various populations at risk; i.e., Kuwaiti and Saudi civilians, U.S. Embassy staff and dependents, U.S. civilian workers and families, and DoD military and civilian personnel. The EPA working group believes that there are increased health risks. However, they cannot determine the magnitude of the risk with any degree of certainty without further measurements and surveys (Draft Interagency Interim Report - Attachment 1). The EPA health assessment team concluded "Current data cannot be used effectively in a risk assessment, especially for long-term risk" (Attachment 2).

The ASD(Health Affairs) has formed a Tri-Service working group to evaluate EPA and DoD data on potential health hazards. The Army Surgeon General has the DoD lead on the assessment (Attachment 3). Their efforts could be limited, however, because of the preliminary nature of the initial air sampling data from the EPA team.

Your assistance is needed to ensure a team of DoD scientists and engineers collects environmental health samples at DoD military and civilian personnel locations for use in assessing the health risk to our personnel. The team would support CENTCOM's current medical activities and conduct air monitoring and evaluations of risks beyond CENTCOM's capabilities. This monitoring would be in addition to any air monitoring done or planned to be done by the EPA for the State Department or the Governments of Kuwait and Saudi Arabia. The DoD team should work with and share information with the EPA team to assure consistency and validity of the data.

We need to take aggressive action now to ensure the timely collection of solid scientific data in order to help establish DoD policies for: (1) our currently exposed personnel, and

(2) medical follow-up or compensation, now or in the future. It is essential that DoD move ahead to collect exposure data and identify DoD personnel or units who are presently serving, who have served, or will serve in areas impacted by the oil fire smoke. Data collection efforts now will help answer any future questions about possible adverse health effects of Desert Storm service. Timely data are also essential to communicate true risks to our personnel and their families. Since the U.S. Army Corps of Engineers has a substantial role in the reconstruction of Kuwait, these data are necessary to program any necessary health precautions to protect Corps military and civilian personnel who may have extended exposure times.

We understand that the U.S. Army Environmental Hygiene Agency (USAEHA) is prepared to dispatch an environmental health monitoring and health risk assessment team to the theater. With CENTCOM concurrence and in theater support, we request that you ask the Army to deploy the USAEHA team within two weeks.

The USAEHA Team should report through the Army Surgeon General to the Tri-Service working group on a weekly basis. The scope and protocol of the environmental health monitoring should be coordinated with the Tri-Service working group, CENTCOM and the EPA.

Congressional, scientific and public interest in this issue is growing. We view the above actions necessary to help protect the health of our personnel and to limit any future liabilities and controversies.

Thank you for your assistance. Please contact George Siebert on (703) 695-0110 if any questions should arise.


Thomas E. Baca
Deputy Assistant Secretary of Defense
(Environment)

Attachments (3)

cc: (w/o attachments)
ASD (Force Management and Personnel)
ASD (Health Affairs)
ASA (MR&A)
ASA (IL&E)
ASN (M&RA)
ASN (I&E)
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